FLORENCE COPPER

FLORENCE COPPER INC.
1575 W. Hunt Highway, Florence, Arizona 85132 USA
florencecopper.com

January 20, 2022

U.S. Environmental Protection Agency, Region 9
Drinking Water Protection Section (WTR 3-2)
75 Hawthorne Street
San Francisco, California 94105

Attention: David Albright, Manager, Ground Water Office

Subject: 2021 Year 3 Post Closure Modeling Audit Report
Underground Injection Control (UIC) Area Permit No. R9UIC-AZ3-FY11-1

Dear Mr. Albright:

Florence Copper Inc. (Florence Copper) is regulated under UIC Area Permit No. R9UIC-AZ3-FY11-1, issued December 20, 2016, for operation of the Production Test Facility (PTF). The PTF began active in-situ copper recovery (ISCR) operations on December 15, 2018. Formation rinsing began at the PTF on June 26, 2020. The Technical Memorandum included as Attachment 1 summarizes the model audit information required in accordance with Part II, Section J of the UIC Area permit for Year 3 of Post-Closure of the PTF, and includes a separate memorandum (Exhibit 1) that details the model update.

The site groundwater flow model was revised in June 2021 with updated pumping rates and new irrigation wells. No new hydrologic, lithologic, or geophysical data were generated during 2021 within the ISCR wellfield area, and no resource blocks were in operation during 2021. Consequently, no additional data were available to update the model and no other changes were made to the groundwater flow model during 2021.

The contents of this report are believed to be accurate and complete based upon the data submitted to me and reviewed by me. Please call (520) 316-3710 should you have any questions concerning this report.

Sincerely,
Florence Copper Inc.

Brent Berg
General Manager

Enclosures:
Attachment 1 – Year 3 Post-Closure Modeling Audit Technical Memorandum
Exhibit 1 – Irrigation Well Groundwater Model Simulations Provided in Support of Florence Copper's October 2019 Application for UIC Permit

ATTACHMENT 1

Year 3 Post-Closure Modeling Audit Technical Memorandum

HALEY & ALDRICH, INC.
One Arizona Center
400 E. Van Buren St., Suite 545
Phoenix, AZ 85004
602.760.2450

TECHNICAL MEMORANDUM

20 January 2022
File No. 204383-000

TO:	Florence Copper Inc. Brent Berg, General Manager
FROM:	Haley & Aldrich, Inc. Mark Nicholls, R.G. Laura Menken, R.G.
SUBJECT:	Year 3 Post-Closure Modeling Audit in Response to Part II, Section J of Underground Injection Control (UIC) Permit No. R9UIC-AZ3-FY11-1.

This Technical Memorandum documents a post-closure audit of the groundwater model developed in support of the Florence Copper Project in accordance with Part II, Section J of UIC permit R9UIC-AZ3-FY11-1 (UIC Permit). Part II, Section J of the UIC Permit requires the verification that the pollutant fate and transport model behaves as predicted through a post-closure audit of modeling during the third, fifth, seventh, tenth, fifteenth, twentieth, and twenty-fifth years after the commencement of in-situ copper recovery (ISCR) operations, or as otherwise directed by the U.S. Environmental Protection Agency (USEPA). The Production Test Facility (PTF) began operations on 15 December 2018; therefore, 2021 is the third year commencement of ISCR operations. The Post-Closure Modeling Audit Report is required to be submitted following the end of third year post-closure and is required to include the following:

- A description of the post-closure model audit;
- Changes in the conceptual model;
- Any model redesign; and
- Any changes in predicted post-closure conditions.

Each of these required elements are addressed below.

Post Closure Model Audit Description

The PTF wellfield includes four injection wells, nine recovery wells and seven observation wells. ISCR operations were conducted at the PTF wellfield from December 2018 until June 2020. The PTF wellfield is currently undergoing formation rinsing and has not entered closure. Because the PTF wellfield is still in an active state of rinsing and no resource blocks are active, no operational data exist to evaluate post-closure model performance.

The typical post-closure model audit will include a model update to incorporate data developed since the last model update, evaluation of the model calibration, and comparison of fate and transport simulations to actual observed conditions. The results of this audit will then be used to evaluate the need to revise the conceptual model, redesign the groundwater model, and identify changes to predicted post-closure conditions.

No new hydrologic, lithologic, or geophysical data have been generated since the PTF began operations in 2018. However, during 2021, the groundwater flow model was updated to incorporate newly installed irrigation wells and updated pumping values for all wells within the model domain as available from the Arizona Department of Water Resources (ADWR). The model calibration was examined following model update and found to be within acceptable performance parameters. The model review did not identify any notable changes to the geologic structure, hydrologic characteristics, or groundwater flow field around the Florence Copper Inc. (Florence Copper) site that would necessitate the revision of the conceptual model or model design.

A Technical Memorandum describing the 2021 model update is included in Exhibit 1.

Changes to the Conceptual Model

No changes have been identified to the geologic structure or hydrologic regimes represented in the Florence Copper groundwater model based on the 2021 groundwater model audit. No changes to the underlying conceptual model are warranted based on the 2021 groundwater model audit.

Redesign of the Groundwater Flow Model

No notable changes have been identified in the groundwater flow field at or surrounding the Florence Copper site based on the 2021 groundwater model update or audit. No changes are required to the design of the Florence Copper groundwater model at this time.

Changes to the Predicted Post-Closure Conditions

No hydraulic, lithologic, or operations changes have been identified that would affect predicted post-closure conditions based on the 2021 groundwater model update or audit. Consequently, no changes are anticipated to the predicted post-closure conditions at this time.

A Technical Memorandum describing the 2021 model update is included as Exhibit 1.

Please contact Mark Nicholls (602-819-0913) with any questions you may have regarding this memo.

Attachments:
Exhibit 1 – Irrigation Well Groundwater Model Simulations Provided in Support of Florence Copper's October 2019 Application for UIC Permit

EXHIBIT 1

Irrigation Well Groundwater Model Simulations Provided in Support of Florence Copper's October 2019 Application for UIC Permit

HALEY & ALDRICH, INC.
One Arizona Center
400 E. Van Buren St., Suite 545
Phoenix, AZ 85004
602.760.2450

TECHNICAL MEMORANDUM

29 March 2021
File No. 132473-005

TO: Florence Copper Inc.
Brent Berg, General Manager

FROM: Haley & Aldrich, Inc.
Jacob Chu, Ph.D.
Miao Zhang, P.E.
Mark Nicholls, R.G.

SUBJECT: Irrigation Well Groundwater Model Simulations Provided in Support of Florence Copper's October 2019 Application for UIC Permit

At the request of Florence Copper Inc. (Florence Copper), Haley & Aldrich, Inc. (Haley & Aldrich) conducted model simulations to evaluate the effects of pumping at two new irrigation wells, designated N1 and N2. These wells would be operated during and after the in-situ copper recovery (ISCR) operations that are planned to occur under the above-reference underground injection control (UIC) permit (Permit), in lieu of existing irrigation wells BIA-9 and BIA-10B which would be plugged and abandoned in accordance with the terms of the Permit. The well locations are depicted in Figure 1.

Haley & Aldrich's simulations consisted generally of two parts: (1) evaluation of the possible effects of operating the new irrigation wells on migration of ISCR-injected fluids (ISCR Injection Simulations); and (2) evaluation of the possible effects of operating the new irrigation wells on the discharge impact area for a hypothetical period of 30 years following the conclusion of ISCR operations (Discharge Impact Area Simulation). Each simulation was run as a solute transport simulation using the same groundwater model described in Attachment A of the 4 October 2019 application for the UIC permit (Application). Specifically, the ISCR operations, discharge impact area, and other model inputs and configurations were held the same as described in Attachment A of the Application, including Section A.3.2.2 and Exhibit A-2, with the exception of the two new irrigation wells and update of planned facility makeup water production. The simulations and their results are described below.

Updated Model Used to Conduct the Simulations

The original groundwater flow model was developed as part of a hydrogeologic study conducted in support of the UIC permit and aquifer protection permit (APP) applications. The original model had a calibration period extending from 1984 through 2010 and was used by the U.S. Environmental Protection Agency (USEPA) to assess hypothetical, potential discharge impacts resulting from Florence Copper's ISCR production test facility operations.

As described in Attachment A, Exhibit A-2 of the Application, the original model was updated in 2019 in support of the applications for APP and UIC Permit of Florence Copper's planned ISCR commercial operations. The 2019 model update:

- Extended the model to run from 1984 through 2018;
- Incorporated additional regional pumping well and water level data through 2018 (the most recent data available at the time); and
- Was calibrated against additional observed water level data by adjusting the general head and recharge boundary conditions between 2011 and 2018 to reflect variation of water exchange across the model domain.

Model Inputs and Configurations Employed in the Simulations

Hydraulic Properties

All hydraulic properties and boundary conditions used in the 2019 updated model were kept the same for the ISCR Injection Simulations and the Discharge Impact Area Simulation. The hydraulic properties applied at the location of each of the hypothetical injection wells in the ISCR Injection Simulations are listed in Table 1.

General Head Boundaries

The general head boundary (GHB) head value for each GHB cell was set to be the GHB head value for the last stress period in the 2019 updated model, while the GHB conductance remained the same.

Recharge

The recharge distribution was set to be the same as the recharge distribution for the last stress period in the 2019 updated model.

Initial Heads

The simulated head for the last time step of the 2019 updated model was used as the initial head.

Pumping Wells

The pumping conditions for the last stress period of the 2019 updated model (i.e., year 2018) were used. However, added to these conditions was pumping at the additional wells, depicted in Figure 1, each at its planned capacity with a conservative 100 percent duty cycle. The well names and specified pumping rates are:

- Well N1: 1,030 gallons per minute (gpm)
- Well N2: 1,300 gpm

Wells N1 and N2 were screened in model layers 1 through 5, which is consistent with typical irrigation wells completed in the area.

Note, based on information provided by San Carlos Irrigation Project, the aggregate production capacity of wells BIA-9 and BIA-10B is no more than 2,330 gpm.

Injection Wells

Five injection wells were rendered for the ISCR Injection Simulations. The same five injection wells were considered in the 2019 model runs.

The Sidewinder Fault Injection Well penetrates the fault in model layer 7, just below the exclusion zone in the Bedrock Oxide Unit. The NW Injection Well penetrates the Sidewinder fault in model layer 10, near the base of the Bedrock Oxide Unit. The Bedrock Oxide Unit thins on the eastern edge of the ISCR area and thickens to the west. Where the injection zone thins, the injection rate was reduced below 60 gpm and was set at a value of 0.15 gpm per foot of injection zone. Due to variation in the thickness of the Bedrock Oxide Unit, this adjustment was applied where the injection zone is less than 400 feet thick. Where the injection is thicker than 400 feet, the injection rate was maintained at 60 gpm. The injection zone thickness at the well simulated at the northeastern corner of the ISCR area was approximately 220 feet thick, and consequently, the injection rate at this location was set at 33 gpm. The other four wells were maintained at an injection rate of 60 gpm.

Simulation Period

The simulation periods for the ISCR Injection Simulations were 48 hours and 30 days. The simulation period for the Discharge Impact Area Simulation was 30 years.

Initial Concentrations

In the ISCR Injection Simulations, initial solute concentration was set at 0 milligrams per liter (mg/L) across the entire model domain. In the Discharge Impact Area Simulation, initial solute concentration was set at 0 mg/L across the model domain except for the ISCR wellfield area, which had an initial concentration of 750 mg/L in model layers 7 through 10.

Specified Concentration Boundary

Solute concentrations were set at 10,000 mg/L in the five injection wells in the ISCR Injection Simulations. There is no specified concentration boundary in the Discharge Impact Area Simulation.

Other Transport Parameters and Solver Settings

All other transport parameters and solver settings were kept the same as those used in the 2019 updated model. Longitudinal, transverse, and vertical transverse dispersivity values were 10, 1, and 0.1 feet, respectively. The simulated solute was conservative (with no sorption or reaction).

ISCR Injection Simulations with New Irrigation Wells

Haley & Aldrich used the 2019 updated model to evaluate the potential distance of migration of ISCR injection fluids resulting from ISCR injections at hypothetical injection wells located along the perimeter of the planned ISCR wellfield, with the new irrigation wells pumping. The hypothetical injection wells are the same as those employed in the 2019 model runs. Section A.3.2.2 of the Application explains that the wells' locations were spaced widely apart from one another to allow evaluation of injection zone differences that are reflected in the model construction.

One hypothetical injection well was placed in each corner of the ISCR area and one additional hypothetical injection well was placed in the Sidewinder fault where it crosses the northern boundary of the ISCR wellfield. These wells are identified as NW Injection Well, NE Injection Well, SW Injection Well, SE Injection Well, and Sidewinder Fault Injection Well. The locations of these wells are shown on Figures 2 through 11.

Each of the injection wells was simulated to inject fluids for a period of 48 hours and 30 days, without any extraction pumping or hydraulic control, to evaluate the potential effects of injection under an unrealistic worst-case scenario, as was done for the 2019 model runs.[1]

Figures A-4 through A-13 of the Application depict the results of the 2019 model runs, which were conducted without pumping from the new irrigation wells described in this memo. Those figures are included in Exhibit A-8-1 of this memo.

Figures 2 through 11 of this memo depict the results of the same model runs with the new irrigation wells pumping. The model files for these runs are included in Exhibit A-8-2 of this memo.

[1] Model scenarios simulating injection without hydraulic control for periods of 48 hours and 30 days were developed based on requests by the USEPA; however, they do not represent planned or realistic ISCR operations. There is no circumstance in which Florence Copper would continue to inject raffinate after a loss of hydraulic control pumping. Based on the applicable contingency plans included in the APP and that would be included in the UIC permit, if hydraulic control is lost, Florence Copper would cease injection and not resume injection until hydraulic control had been reestablished. Moreover, the basic purpose of the pilot-scale ISCR operations, which were conducted under the production test facility (PTF) UIC permit, was to demonstrate that hydraulic control can be maintained to prevent excursions of ISCR solutes beyond the limits of the aquifer exemption. That demonstration was made according to the terms of the PTF UIC permit, using ISCR wells that were constructed and operated in the same manner and at the same depths as the wells that would be constructed and operated for the commercial-scale operations.

The model scenarios and results are discussed below.

NW Injection Well 48 Hours (Figure 2 and Application Figure A-4)

Horizontal Migration

- In the 2019 model simulation (without the new irrigation wells pumping), injection at the hypothetical NW Injection Well for a period of 48 hours, without extraction or any type of hydraulic control, resulted in 138 feet of horizontal migration of injected solution.
- In the model simulation with the new irrigation wells pumping, injection at the hypothetical NW Injection Well for a period of 48 hours without extraction or any type of hydraulic control resulted in 125 feet of horizontal migration of injected solution (a difference of 13 feet less migration). The maximum distance of horizontal migration was in model layer 10, where the Sidewinder fault intersects the well.

Vertical Migration

- In the 2019 model simulation (without the new irrigation wells pumping), the upper limit of vertical migration occurred 40 feet into model layer 6, which represents the exclusion zone.
- In the model simulation with the new irrigation wells pumping, the vertical migration was the same .

NW Injection Well 30 Hours (Figure 3 and Application Figure A-5)

Horizontal Migration

- In the 2019 model simulation (without the new irrigation wells pumping), injection at the hypothetical NW Injection Well for a period of 30 days without extraction or any type of hydraulic control resulted in 250 feet of horizontal migration of injected solution.
- In the model simulation with the new irrigation wells pumping, injection at the hypothetical NW Injection Well for a period of 30 days without extraction or any type of hydraulic control resulted in 225 feet of horizontal migration of injected solution (a difference of 25 feet less migration). The maximum distance of horizontal migration was in model layer 10, where the Sidewinder fault intersects the well.

Vertical Migration

- In the 2019 model simulation (without the new irrigation wells pumping), the upper limit of vertical migration occurred 40 feet into model layer 6, which represents the exclusion zone.
- In the model simulation with the new irrigation wells pumping, the vertical migration was the same.

NE Injection Well 48 Hours (Figure 4 and Application Figure A-6)

Horizontal Migration

- In the 2019 model simulation (without the new irrigation wells pumping), injection at the hypothetical NE Injection Well for a period of48 hours without extraction or any type of hydraulic control resulted in 66 feet of horizontal migration of injected solution.

- In the model simulation with the new irrigation wells pumping, injection at the hypothetical NE Injection Well for a period of 48 hours without extraction or any type of hydraulic control resulted in 69 feet of horizontal migration of injected solution (a difference of 3 feet more migration). The maximum distance of horizontal migration was in model layers 7 and 8, which represent the upper Bedrock Oxide Unit.

Vertical Migration

- In the 2019 model simulation (without the new irrigation wells pumping), the upper limit of vertical migration occurred 30 feet into model layer 5, which represents the lower portion of the lower basin fill unit (LBFU).
- In the model simulation with the new irrigation wells pumping, the vertical migration was the same.

NE Injection Well 30 Hours (Figure 5 and Application Figure A-7)

Horizontal Migration

- In the 2019 model simulation (without the new irrigation wells pumping), injection at the hypothetical NE Injection Well for a period of 30 days, without extraction or any type of hydraulic control, resulted in 126 feet of horizontal migration of injected solution.
- In the model simulation with the new irrigation wells pumping, injection at the hypothetical NE Injection Well for a period of 30 days, without extraction or any type of hydraulic control, resulted in 144 feet of horizontal migration of injected solution (a difference of 18 feet more migration). The maximum distance of horizontal migration was in model layers 7 and 8, which represent the upper Bedrock Oxide Unit.

Vertical Migration

- In the 2019 model simulation (without the new irrigation wells pumping), the upper limit of vertical migration occurred through model layers, 6, 5, and 4, which represent the exclusion zone and the full thickness (100 feet at this location) of the LBFU.
- In the model simulation with the new irrigation wells pumping, the vertical migration was the same.

SE Injection Well 48 Hours (Figure 6 and Application Figure A-8)

Horizontal Migration

- In the 2019 model simulation (without the new irrigation wells pumping), injection at the hypothetical SE Injection Well for a period of 48 hours, without extraction or any type of hydraulic control, resulted in 131 feet of horizontal migration of injected solution.
- In the model simulation with the new irrigation wells pumping, injection at the hypothetical SE Injection Well for a period of 48 hours, without extraction or any type of hydraulic control, resulted in 125 feet of horizontal migration of injected solution (a difference of 6 feet less migration). The maximum distance of horizontal migration was in model layers 7 and 8, which represent the upper Bedrock Oxide Unit.

Vertical Migration

- In the 2019 model simulation (without the new irrigation wells pumping), the upper limit of vertical migration occurred through model layer 6 (exclusion zone) and 40 feet into model layer 5, which represents the lower portion of the LBFU.
- In the model simulation with the new irrigation wells pumping, the vertical migration was the same.

SE Injection Well 30 Hours (Figure 7 and Application Figure A-9)

Horizontal Migration

- In the 2019 model simulation (without the new irrigation wells pumping), injection at the hypothetical SE Injection Well for a period of 30 days, without extraction or any type of hydraulic control, resulted in 189 feet of horizontal migration of injected solution.
- In the model simulation with the new irrigation wells pumping, injection at the hypothetical SE Injection Well for a period of 30 days, without extraction or any type of hydraulic control, resulted in 175 feet of horizontal migration of injected solution (a difference of 14 feet less migration). The maximum distance of horizontal migration was in model layers 7 and 8, which represent the upper Bedrock Oxide Unit.

Vertical Migration

- In the 2019 model simulation (without the new irrigation wells pumping), the upper limit of vertical migration occurred through model layers, 6, 5, and 4, which represent the exclusion zone and the full thickness (80 feet at this location) of the LBFU.
- In the model simulation with the new irrigation wells pumping, the vertical migration was the same.

SW Injection Well 48 Hours (Figure 8 and Application Figure A-10)

Horizontal Migration

- In the 2019 model simulation (without the new irrigation wells pumping), injection at the hypothetical SW Injection Well for a period of 48 hours, without extraction or any type of hydraulic control, resulted in 116 feet of horizontal migration of injected solution.
- In the model simulation with the new irrigation wells pumping, injection at the hypothetical SW Injection Well for a period of 48 hours, without extraction or any type of hydraulic control, resulted in 125 feet of horizontal migration of injected solution (a difference of 9 feet more migration). The maximum distance of horizontal migration was in model layers 7 and 8, which represent the upper Bedrock Oxide Unit.

Vertical Migration

- In the 2019 model simulation (without the new irrigation wells pumping), the upper limit of vertical migration occurred 40 feet into model layer 6, which represents the exclusion zone.
- In the model simulation with the new irrigation wells pumping, the vertical migration was the same.

SW Injection Well 30 Hours (Figure 9 and Application Figure A-11)

Horizontal Migration

- In the 2019 model simulation (without the new irrigation wells pumping), injection at the hypothetical SW Injection Well for a period of 30 days, without extraction or any type of hydraulic control, resulted in 169 feet of horizontal migration of injected solution.
- In the model simulation with the new irrigation wells pumping, injection at the hypothetical SW Injection Well for a period of 30 days, without extraction or any type of hydraulic control, resulted in 175 feet of horizontal migration of injected solution (a difference of 6 feet more migration). The maximum distance of horizontal migration was in model layers 7 and 8, which represent the upper Bedrock Oxide Unit.

Vertical Migration

- In the 2019 model simulation (without the new irrigation wells pumping), the upper limit of vertical migration occurred through model layer 6, and into model layer 5, which represents the lower portion of the LBFU.
- In the model simulation with the new irrigation wells pumping, the vertical migration was the same.

Sidewinder Fault Injection Well 48 Hours (Figure 10 and Application Figure A-12)

Horizontal Migration

- In the 2019 model simulation (without the new irrigation wells pumping), injection at the hypothetical Sidewinder Fault Injection Well for a period of 48 hours, without extraction or any type of hydraulic control, resulted in 82 feet of horizontal migration of injected solution.
- In the model simulation with the new irrigation wells pumping, injection at the hypothetical Sidewinder Fault Injection Well for a period of 48 hours, without extraction or any type of hydraulic control, resulted in 81 feet of horizontal migration of injected solution (a difference of 1 foot more migration). The maximum distance of horizontal migration was in model layers 7 and 8, which represent the upper Bedrock Oxide Unit and the location where the Sidewinder fault intersects the well.

Vertical Migration

- In the 2019 model simulation (without the new irrigation wells pumping), the upper limit of vertical migration occurred through model layer 6, and into model layer 5, which represents the lower portion of the LBFU.
- In the model simulation with the new irrigation wells pumping, the vertical migration was the same.

Sidewinder Fault Injection Well 30 Hours (Figure 11 and Application Figure A-13)

Horizontal Migration

- In the 2019 model simulation (without the new irrigation wells pumping), injection at the hypothetical Sidewinder Fault Injection Well for a period of 30 days, without extraction or any type of hydraulic control, resulted in 210 feet of horizontal migration of injected solution.
- In the model simulation with the new irrigation wells pumping, injection at the hypothetical Sidewinder Fault Injection Well for a period of 30 days, without extraction or any type of hydraulic control, resulted in 181 feet of horizontal migration of injected solution (a difference of 29 feet less migration). The maximum distance of horizontal migration was in model layers 7 and 8, which represent the upper Bedrock Oxide Unit and the location where the Sidewinder fault intersects the well.

Vertical Migration

- In the 2019 model simulation (without the new irrigation wells pumping), the upper limit of vertical migration occurred through model layers, 6, 5, and 4, which represent the exclusion zone and the full thickness of the LBFU.
- In the model simulation with the new irrigation wells pumping, the vertical migration was the same.

Figure 12 shows a plan view of the maximum distances of migration under the 48-hour and 30-day injection simulations discussed above.

Discharge Impact Area Simulation with New Irrigation Wells Pumping

Attachment A, Exhibit A-2 of the Application describes the 2019 model simulation of solute transport for a period of 30 years after cessation of ISCR operations (including cessation of hydraulic control). Haley & Aldrich reproduced this model simulation with the addition of the new irrigation wells pumping continuously at the rates stated above.

As in the 2019 model run, the extent of migration is defined by the outer 2 mg/L concentration contours for all of the layers. The faults, which were assigned a hydraulic conductivity ten times higher than the surrounding bedrock, slightly enhance migration during the 30-year period.

The solute transport defined by the 2 mg/L concentration contour with the new irrigation wells pumping is shown on Figure 13. For comparison, the solute transport defined by the 2 mg/L concentration contour without the irrigation wells pumping, as reported in Attachment A, Exhibit A-2 of the Application, is also shown on Figure 13.

Please contact Mark Nicholls (602-819-0913) with any questions you may have regarding this memo.

Attachments:

Table 1 – Groundwater Model Results for Specified Injection Scenarios
Figure 1 – Location of Subject Wells
Figure 2 – Cross Sections NW Injection Well, 48 Hours Injection with no Extraction
Figure 3 – Cross Sections NW Injection Well, 30 Days Injection with no Extraction
Figure 4 – Cross Sections NE Injection Well, 48 Hours Injection with no Extraction
Figure 5 – Cross Sections NE Injection Well, 30 Days Injection with no Extraction
Figure 6 – Cross Sections SE Injection Well, 48 Hours Injection with no Extraction
Figure 7 – Cross Sections SE Injection Well, 30 Days Injection with no Extraction
Figure 8 – Cross Sections SW Injection Well, 48 Hours Injection with no Extraction
Figure 9 – Cross Sections SW Injection Well, 30 Days Injection with no Extraction
Figure 10 – Cross Sections Sidewinder Fault Injection Well, 48 Hours Injection with no Extraction
Figure 11 – Cross Sections Sidewinder Fault Injection Well, 30 Days Injection with no Extraction
Figure 12 – Plan View of Maximum Extent of Migration During 48-Hour and 30-Day Injection Scenarios without Hydraulic Control Pumping
Figure 13 – Discharge Impact Area 30 Years After Closure with New Irrigation Wells Pumping
Exhibit A-8-1 – Figures A-4 through A-13 from the 4 October 2019 UIC Application
Exhibit A-8-2 – Model Files

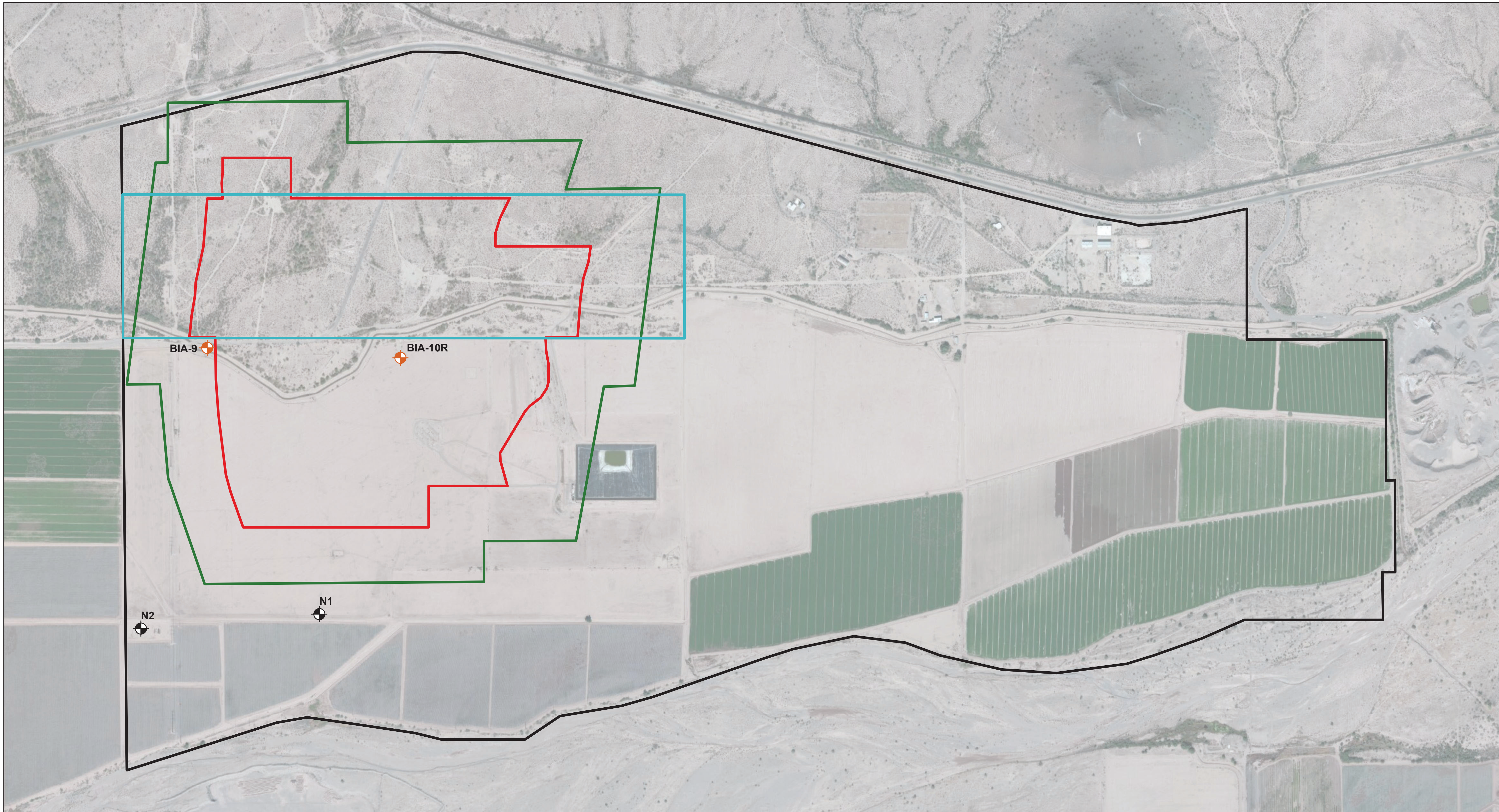
TABLE

TABLE 1
GROUNDWATER MODEL RESULTS
FOR SPECIFIED INJECTION SCENARIOS
FLORENCE COPPER PROJECT
FLORENCE, ARIZONA

	Simulation Period	Injection Rate (gpm)	Porosity of Oxide Layers (%)	Fault Zone Porosity (%)	Fault Zone Hydraulic Conductivity (ft/day)	Maximum Distance of Horizontal Fluid Migration (feet)
NW Well	48 hours	60	5 - 8	10	6	125
	30 days	60	5 - 8	10	6	225
NE Well	48 hours	33	5 - 8	10	6	69
	30 days	33	5 - 8	10	6	144
SW Well	48 hours	60	5 - 8	10	6	125
	30 days	60	5 - 8	10	6	175
SE Well	48 hours	60	5 - 8	10	6	125
	30 days	60	5 - 8	10	6	175
Sidewinder Fault Well	48 hours	60	5 - 8	10	6	81
	30 days	60	5 - 8	10	6	181

Notes:
% = percent
ft/day = feet per day
gpm = gallons per minute

FIGURES



LEGEND

- NEW IRRIGATION WELL
- EXISTING WELL
- STATE MINERAL LEASE BOUNDARY
- AREA OF REVIEW BOUNDARY
- ISCR WELL FIELD
- FLORENCE COPPER PROPERTY BOUNDARY

NOTES

1. ALL LOCATIONS AND DIMENSIONS ARE APPROXIMATE
2. AERIAL IMAGERY SOURCE: ESRI

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SCALE IN FEET

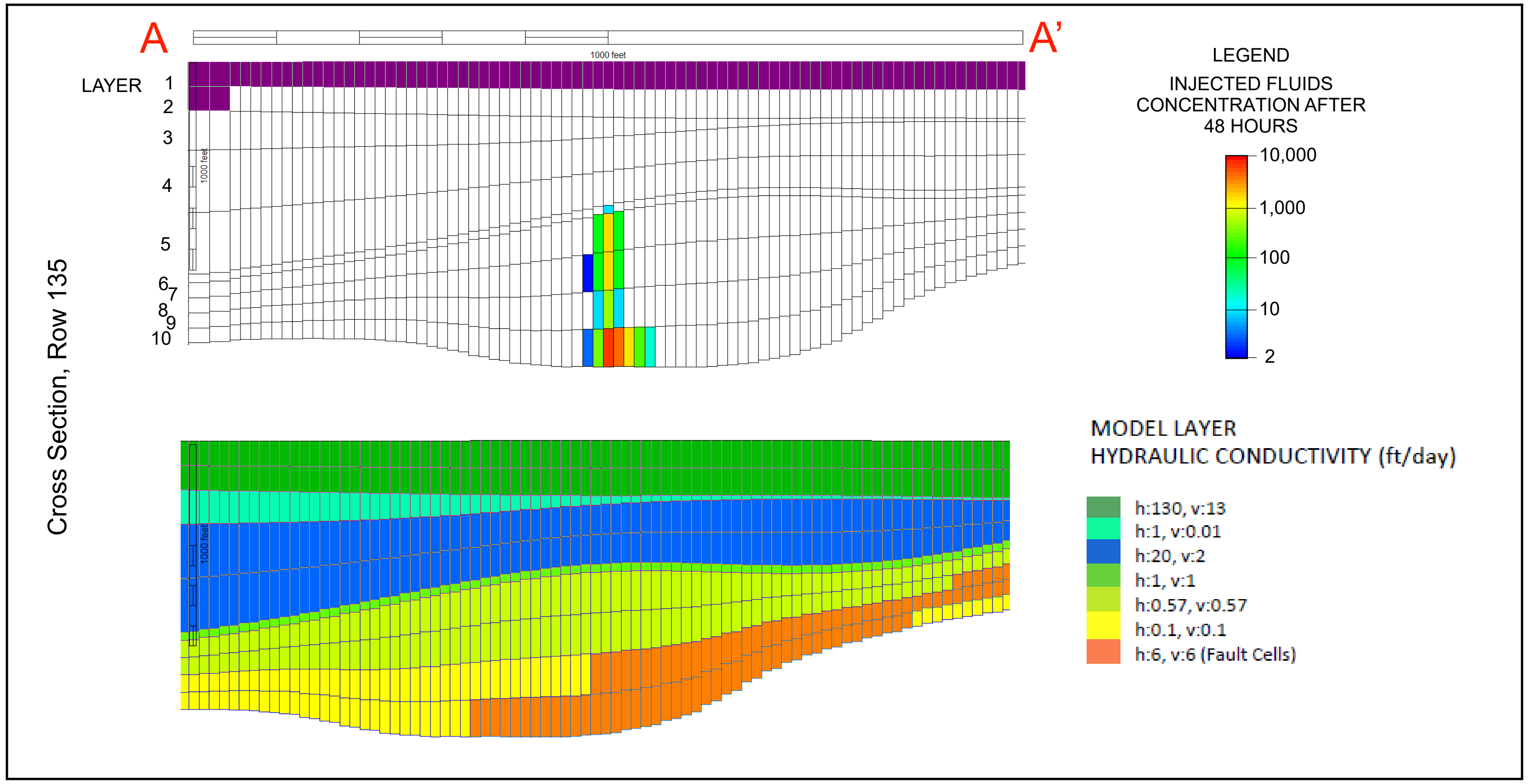
HALEY ALDRICH

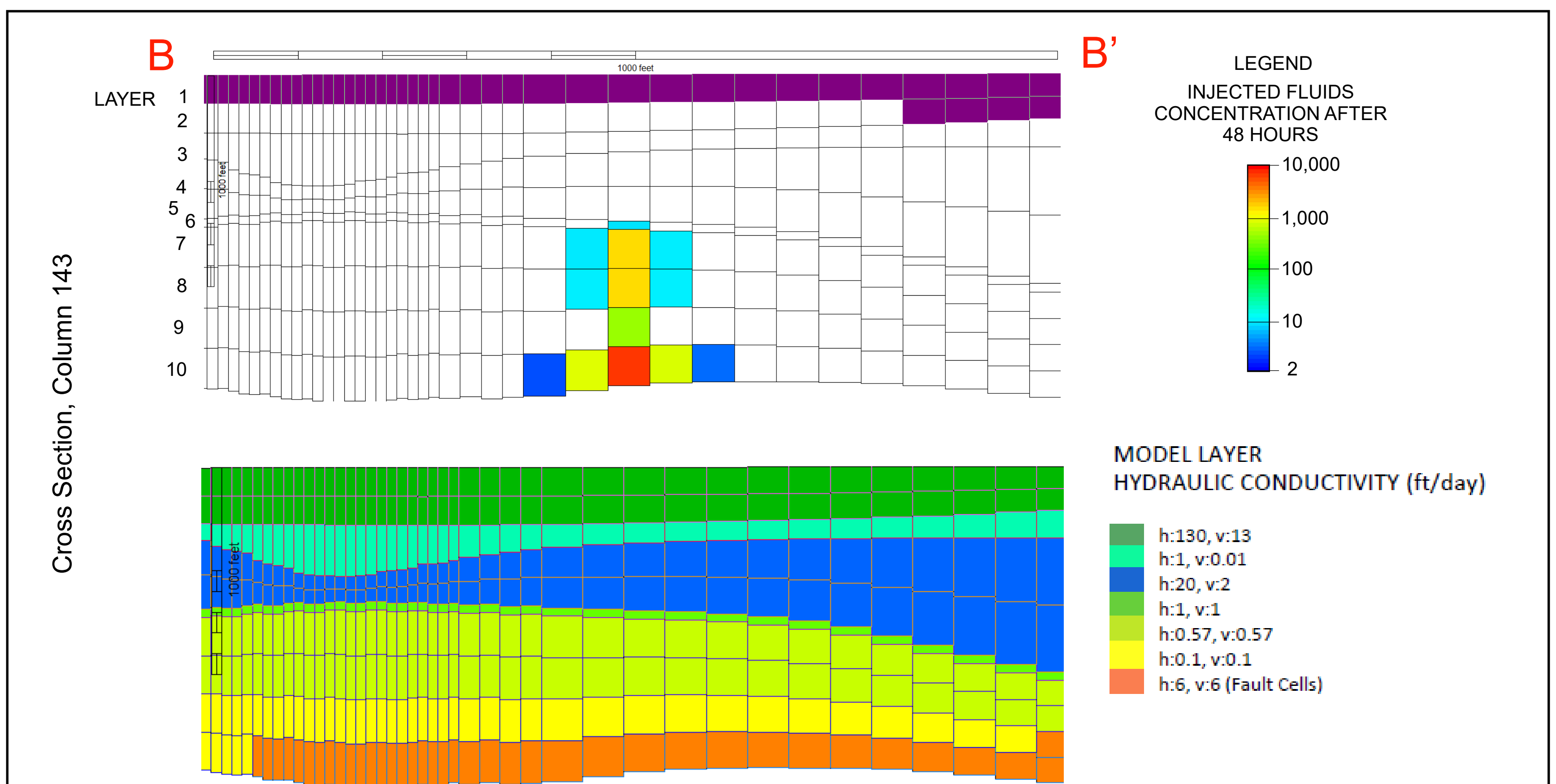
FLORENCE COPPER, INC.
FLORENCE, ARIZONA

LOCATION OF SUBJECT WELLS

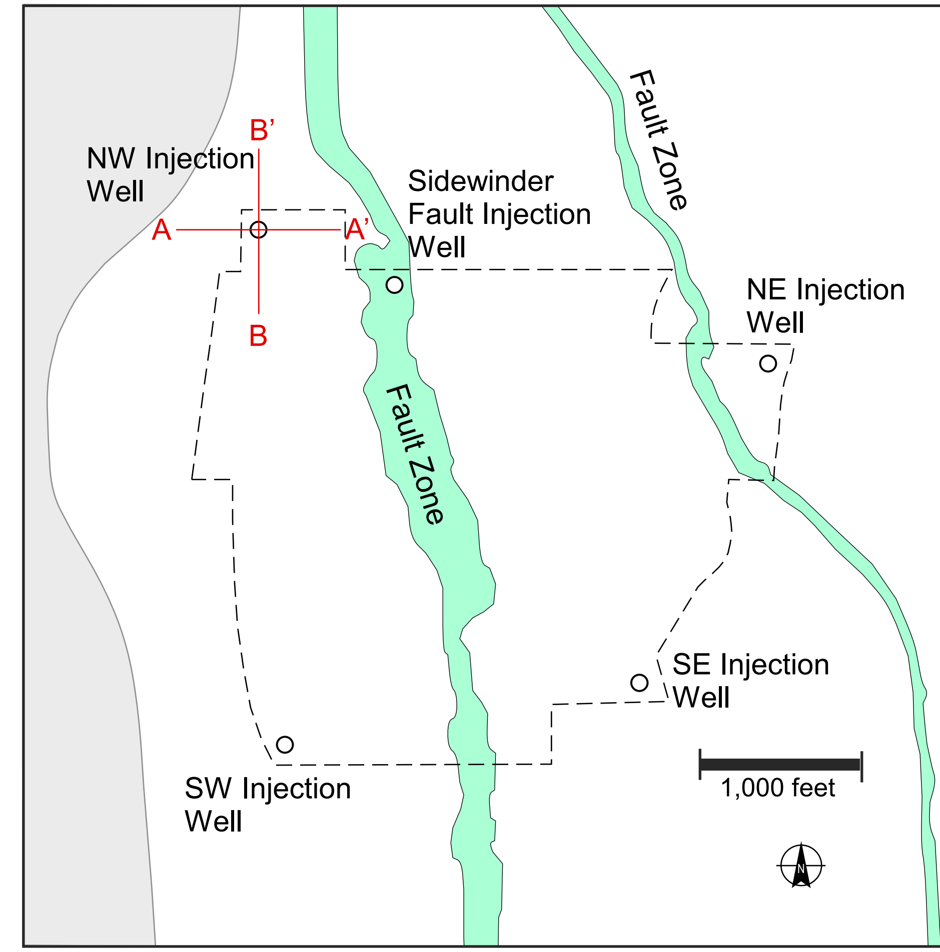
MARCH 2021

FIGURE 1





FAULT LOCATION MAP



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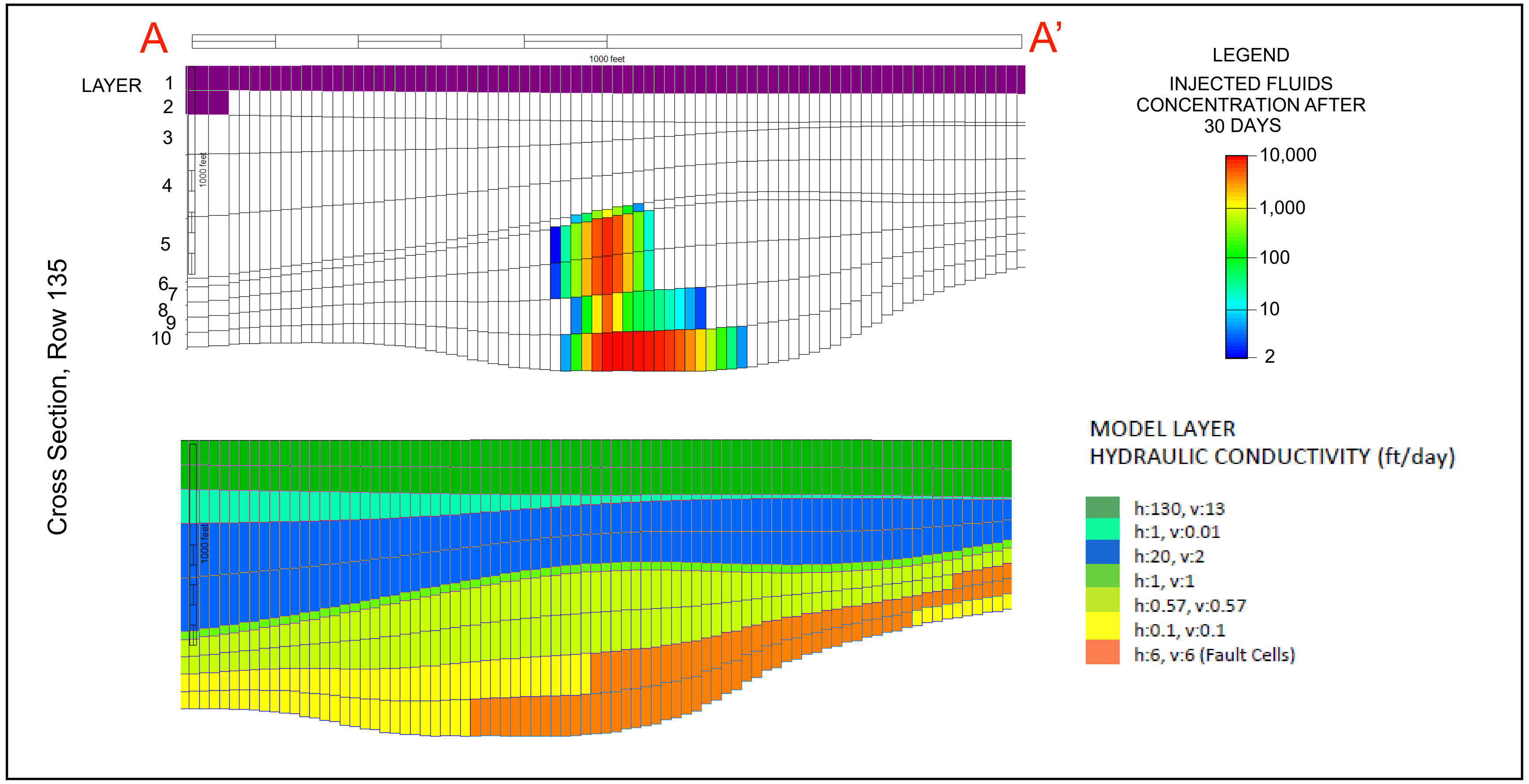
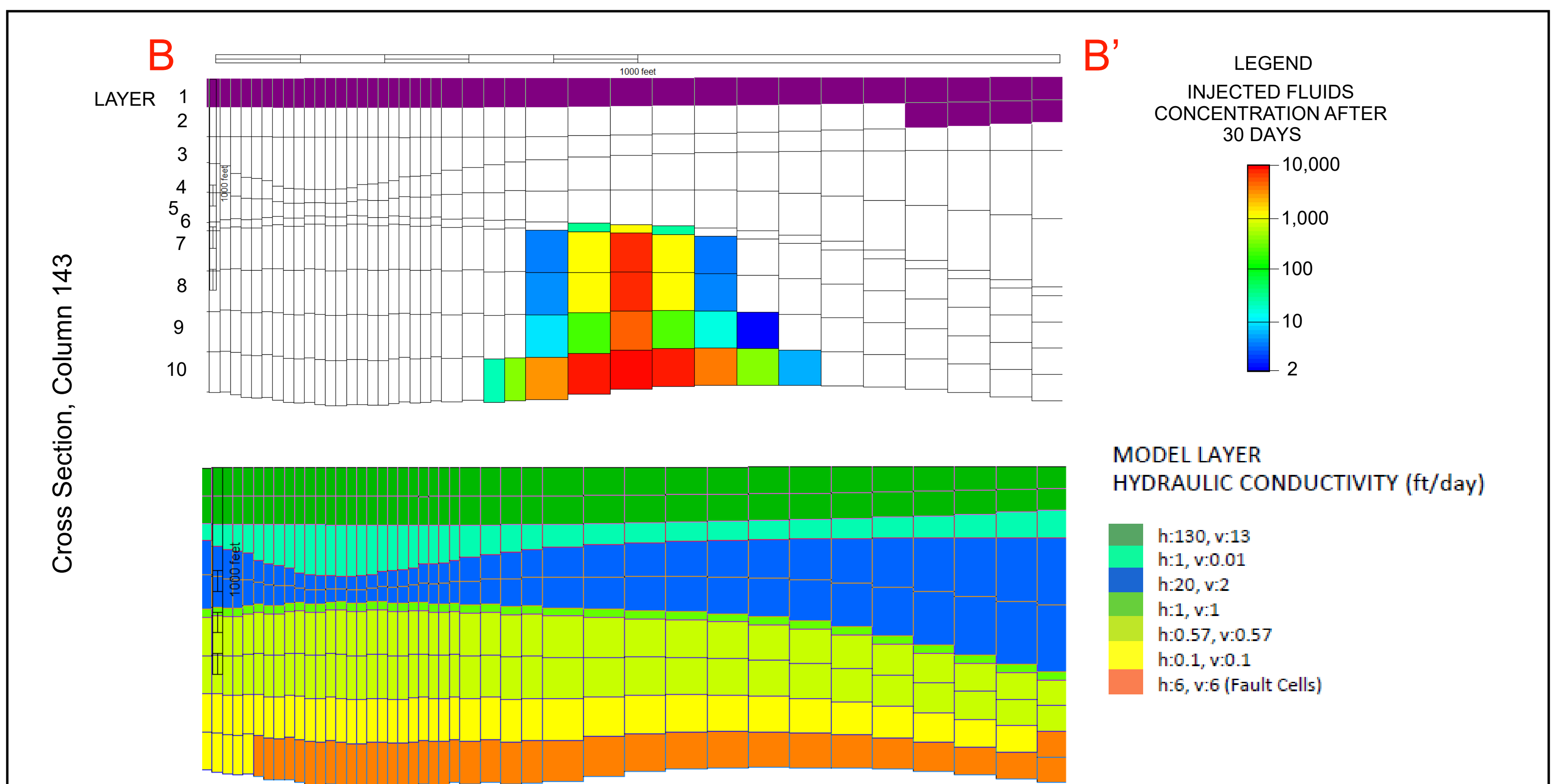
HALEY ALDRICH

CROSS SECTIONS
NW INJECTION WELL, 48 HOURS
INJECTION WITH NO EXTRACTION

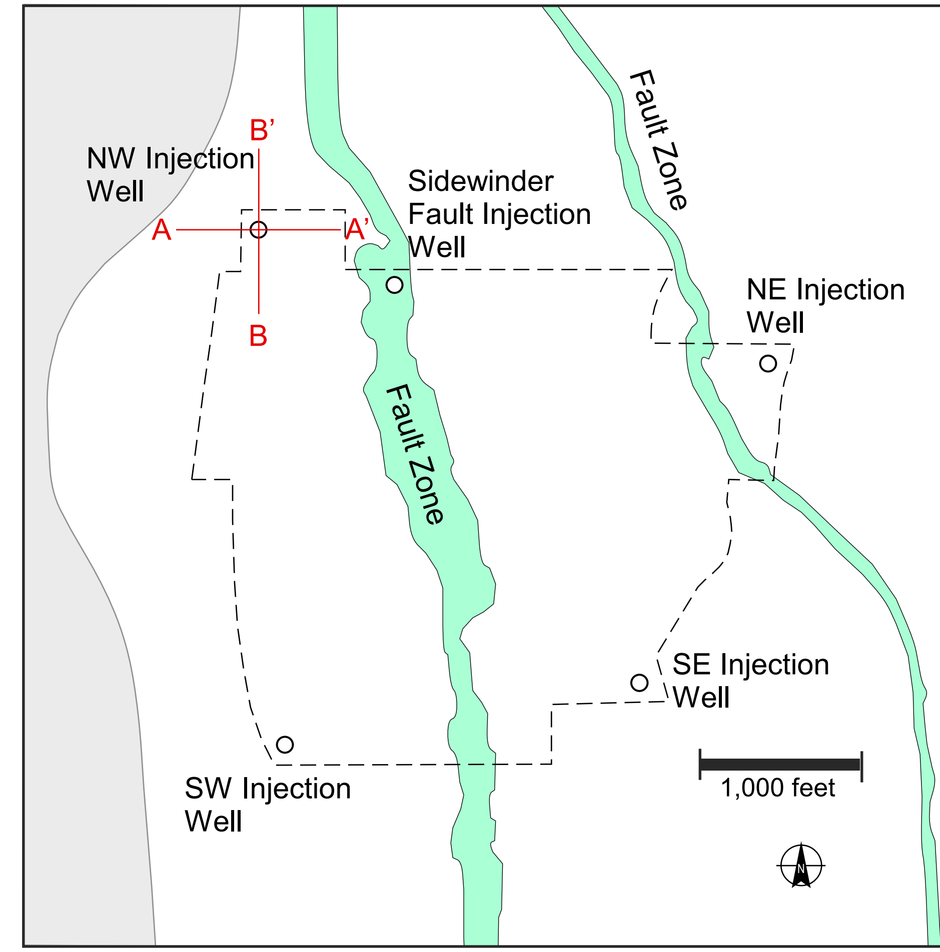
MARCH 2021

FIGURE 2





FAULT LOCATION MAP

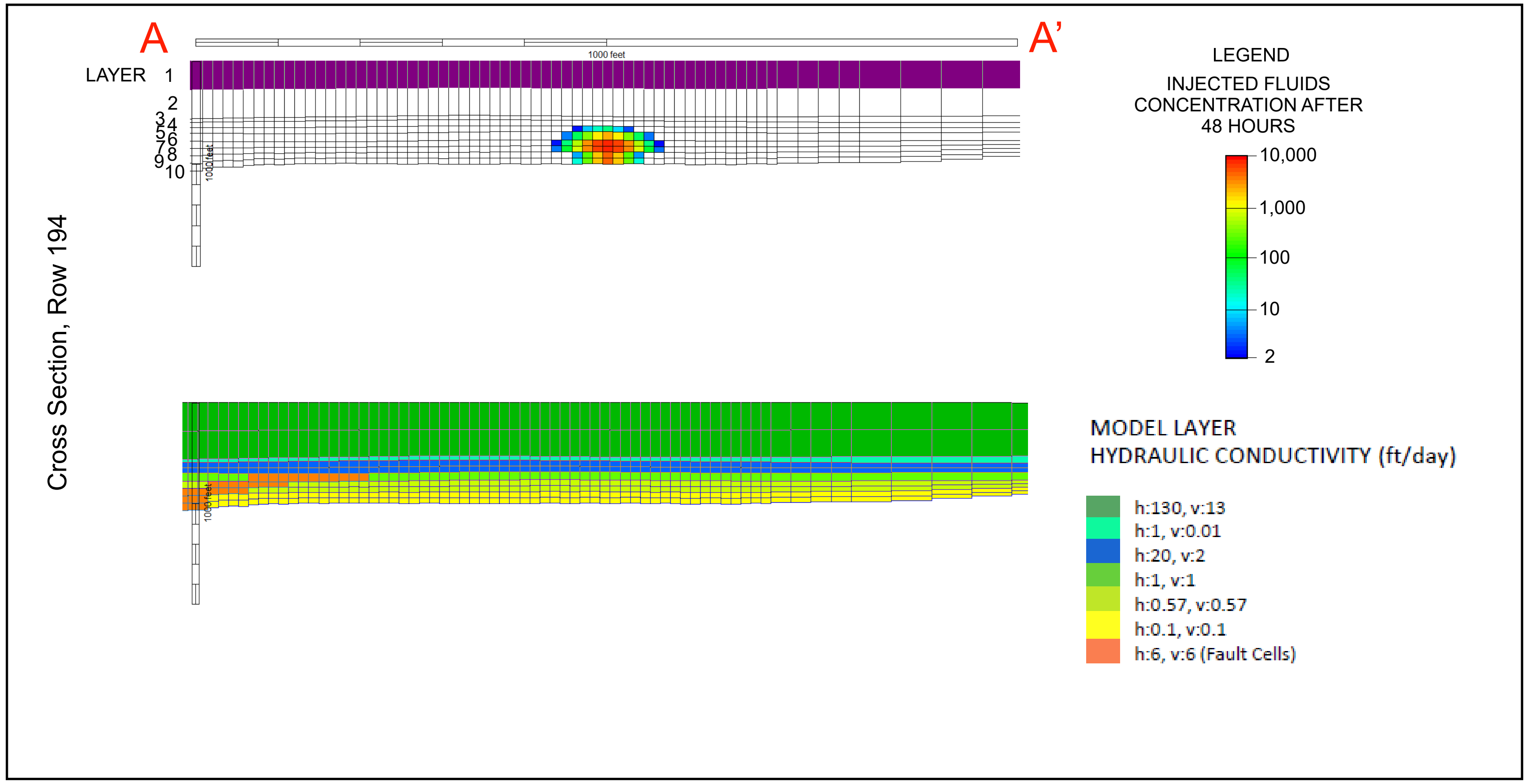


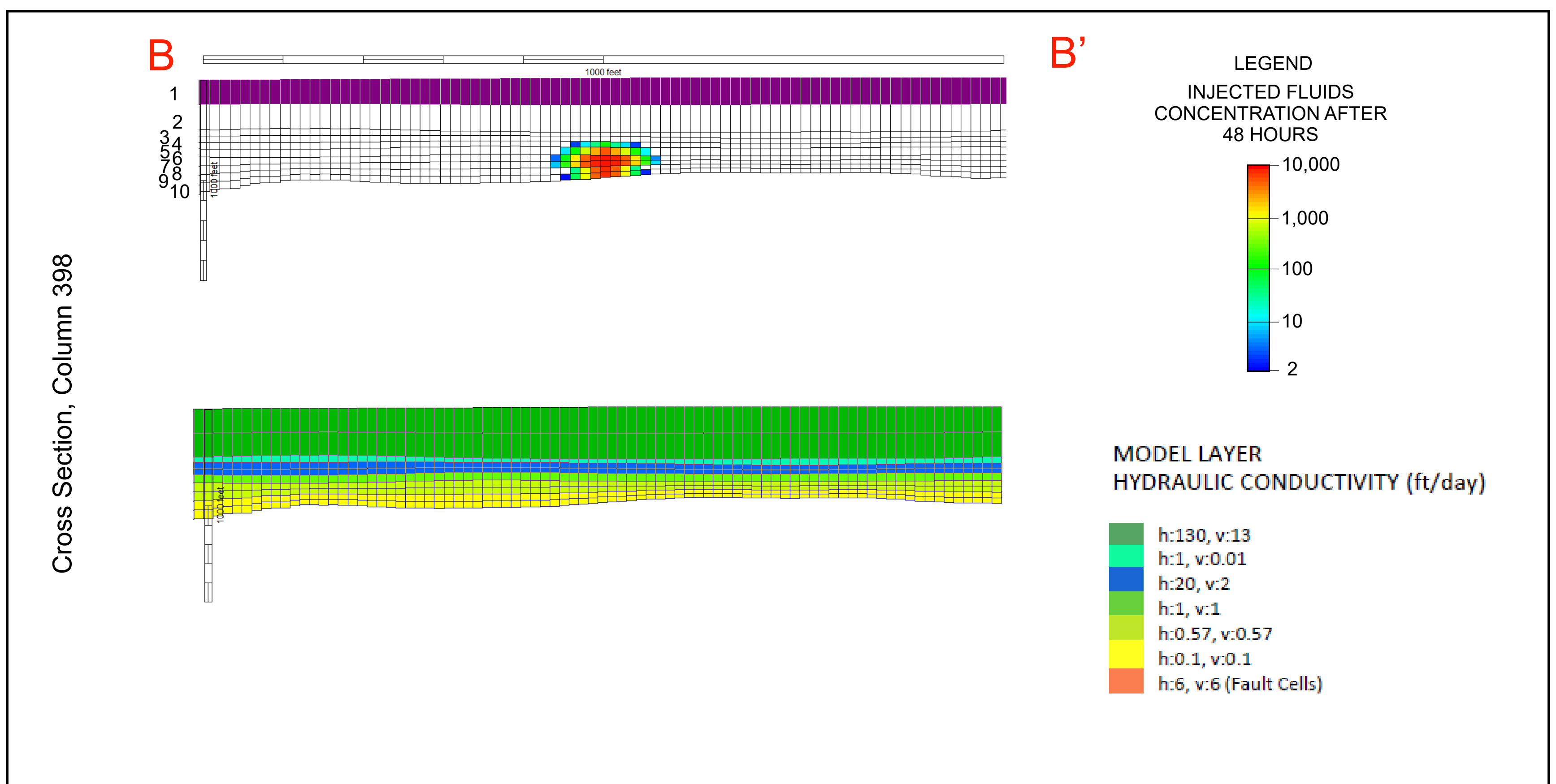
HALEY ALDRICH

CROSS SECTIONS
NW INJECTION WELL, 30 DAYS
INJECTION WITH NO EXTRACTION

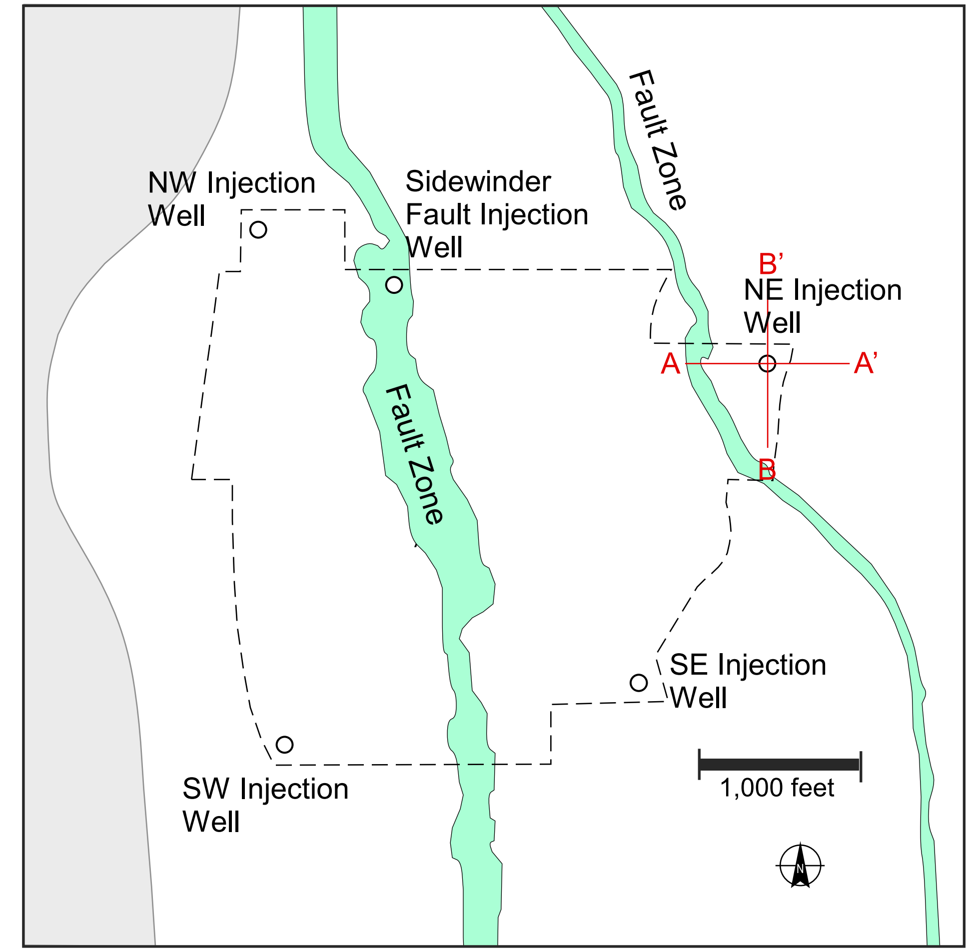
MARCH 2021

FIGURE 3





FAULT LOCATION MAP

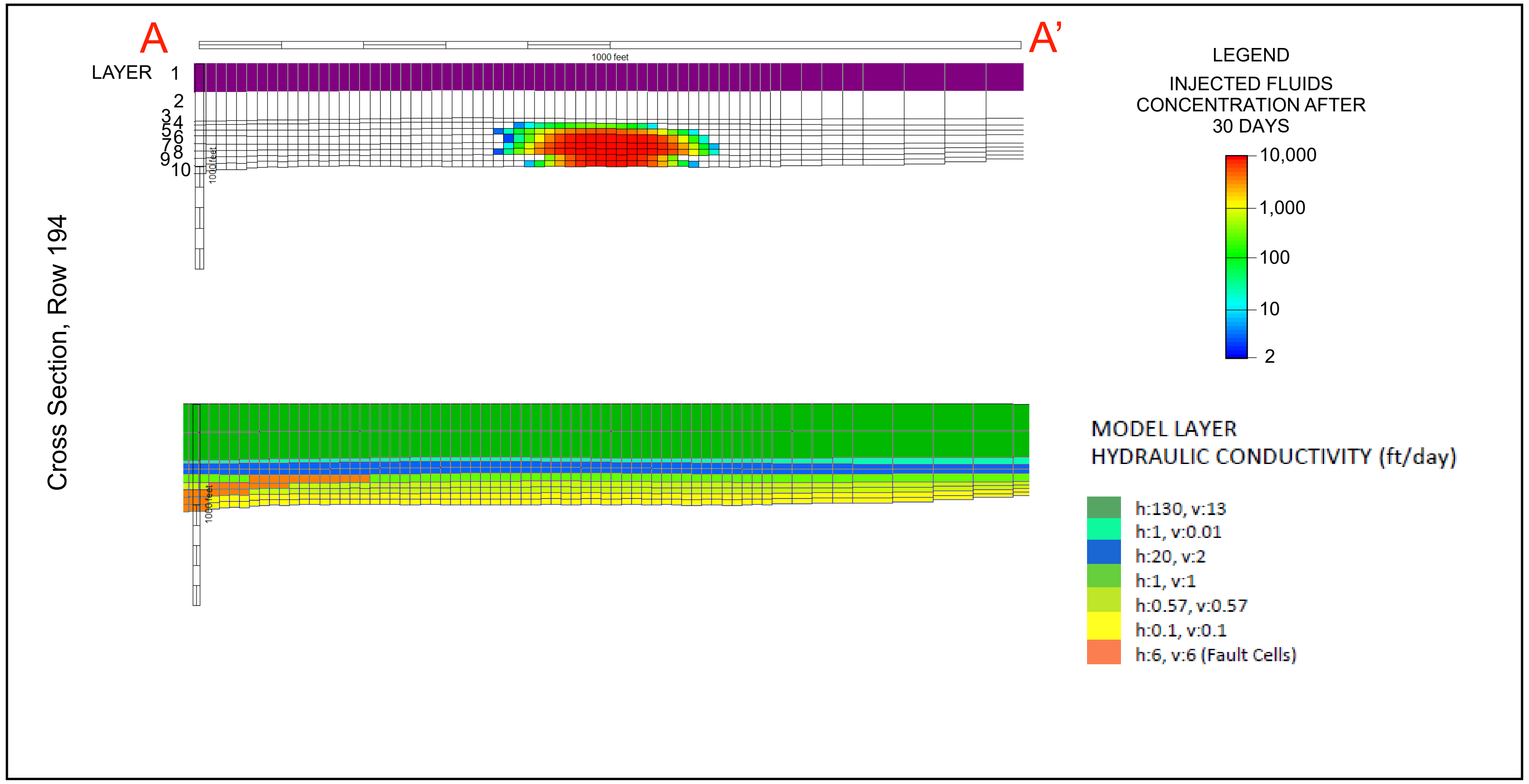


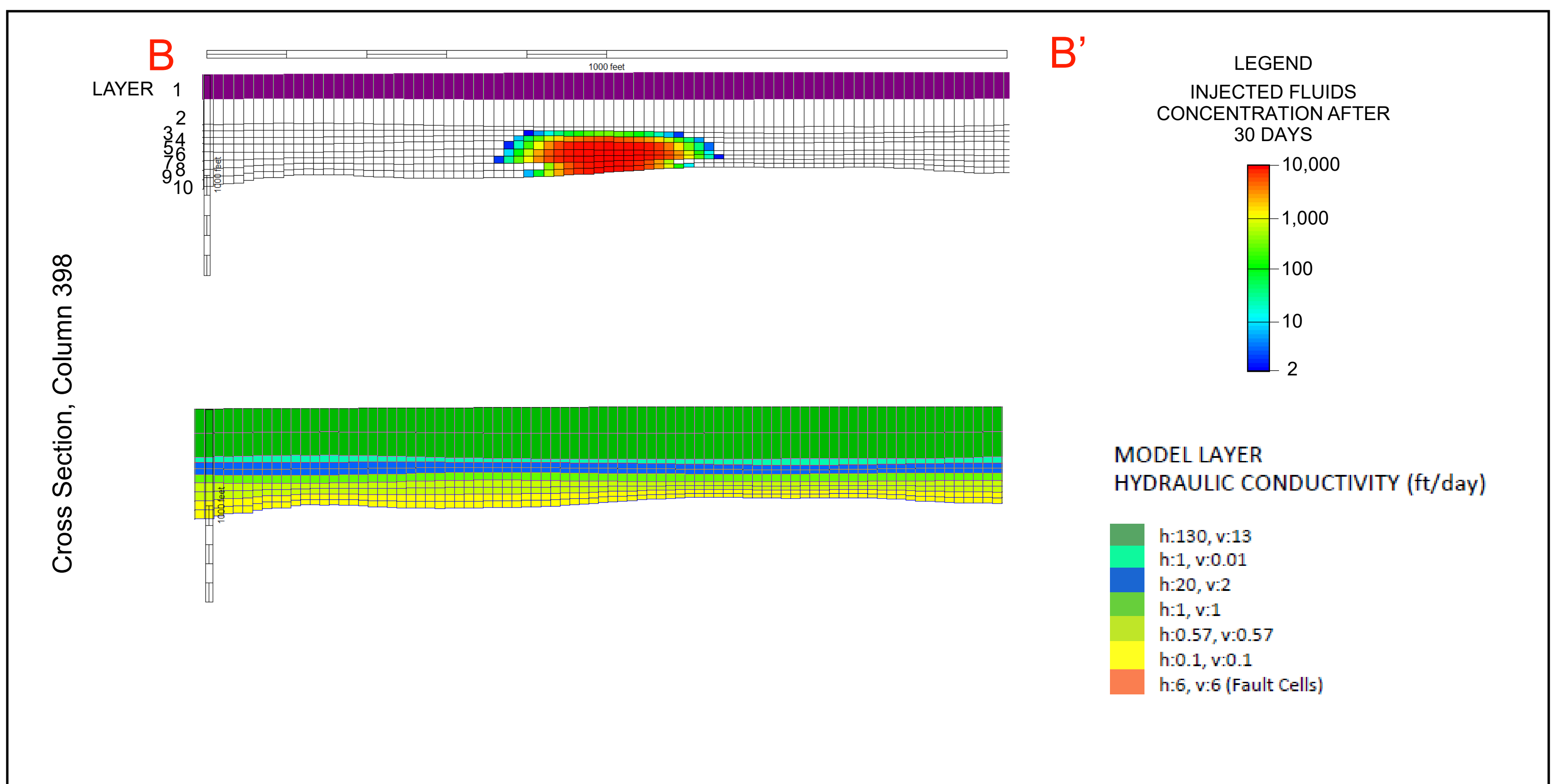
HALEY ALDRICH

CROSS SECTIONS
NE INJECTION WELL, 48 HOURS
INJECTION WITH NO EXTRACTION

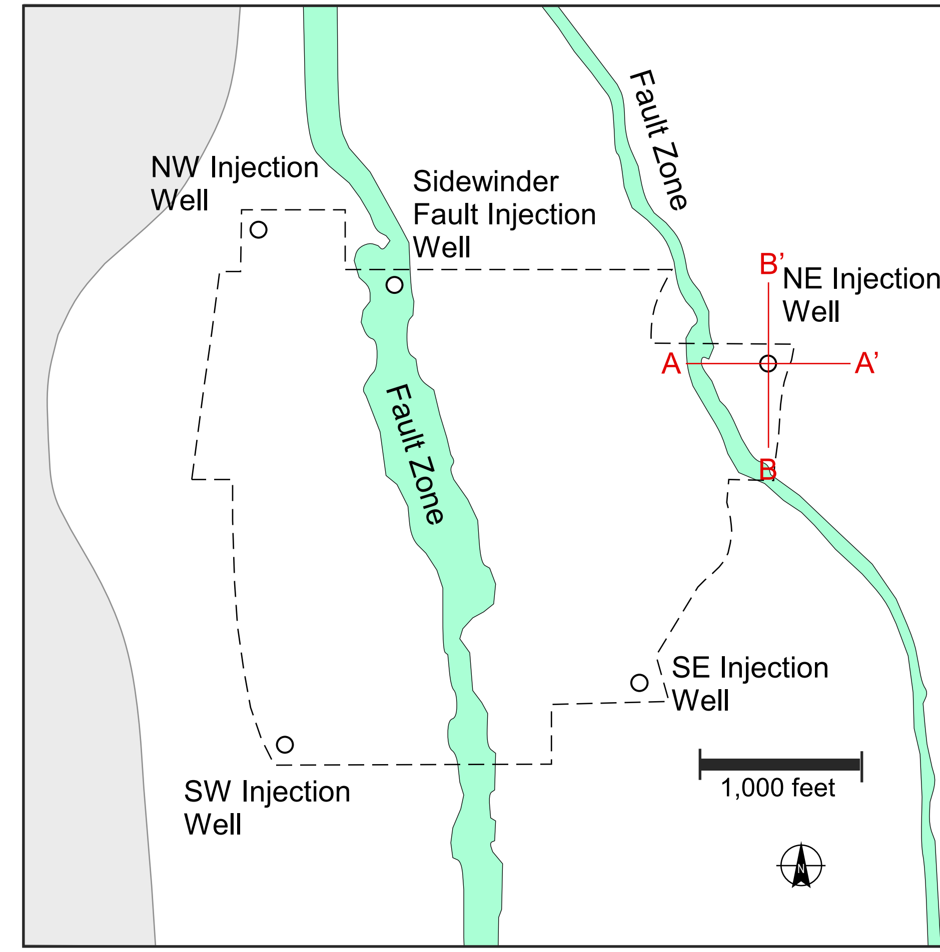
MARCH 2021

FIGURE 4





FAULT LOCATION MAP

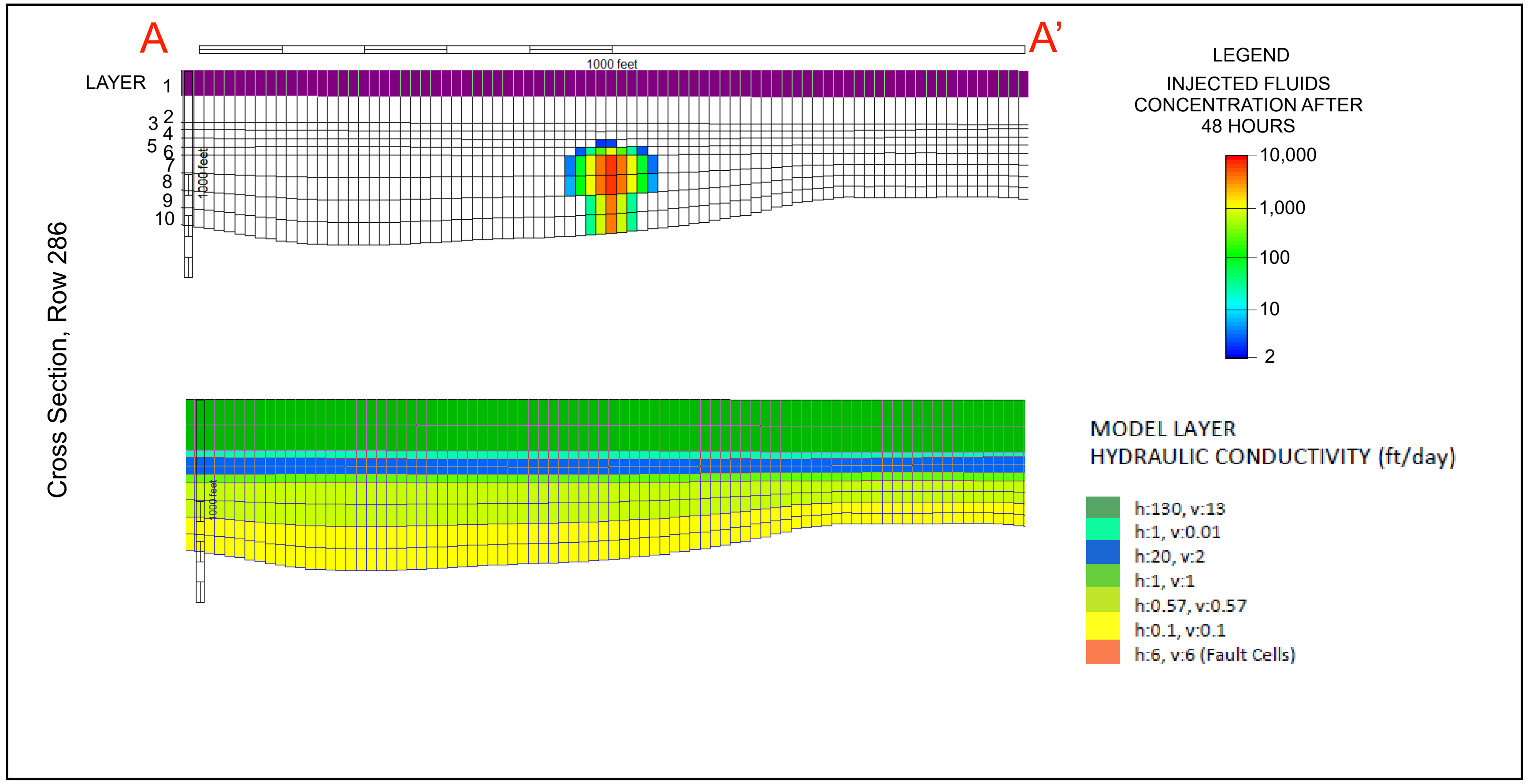


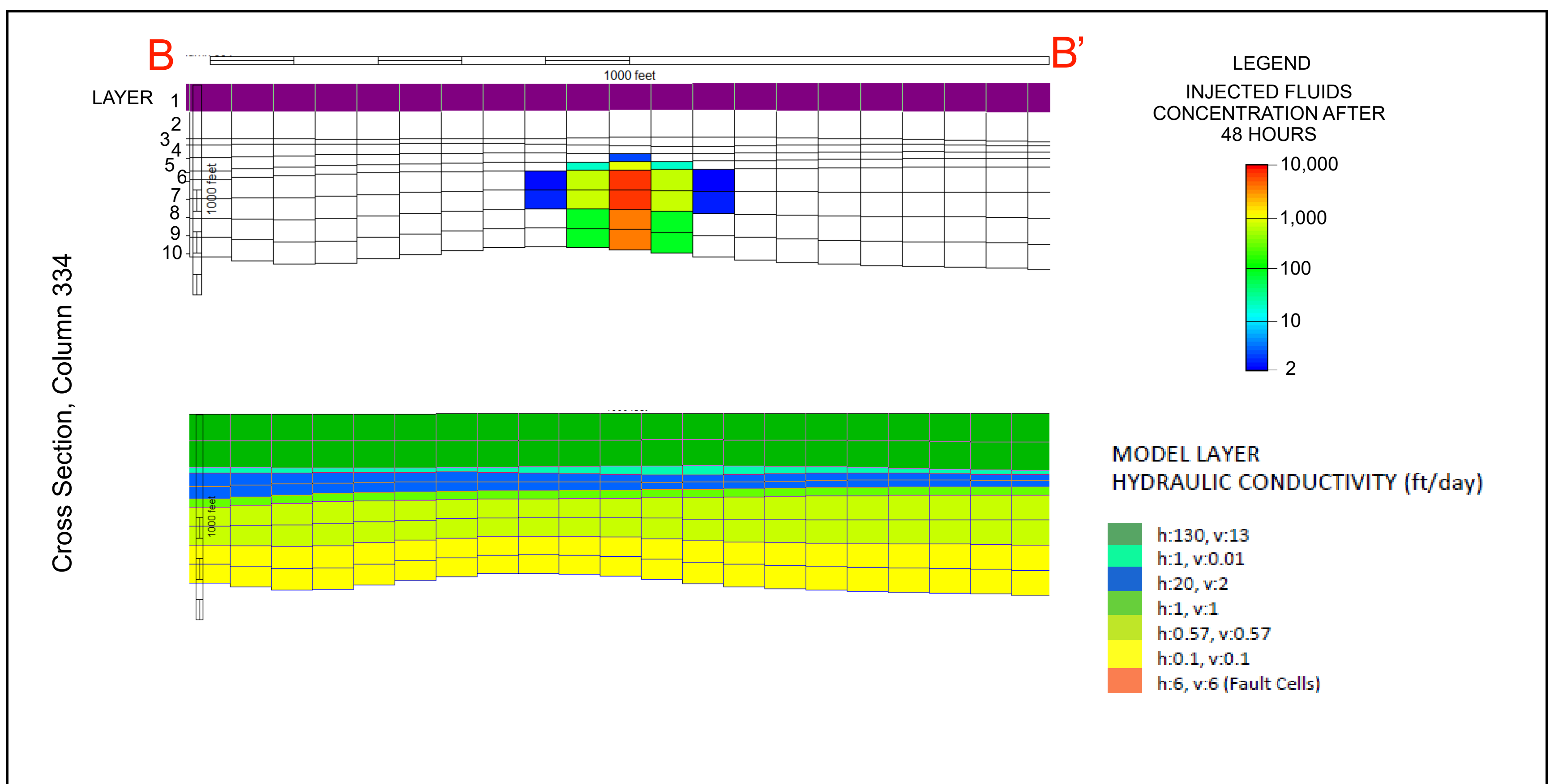
HALEY ALDRICH

CROSS SECTIONS
NE INJECTION WELL, 30 DAYS
INJECTION WITH NO EXTRACTION

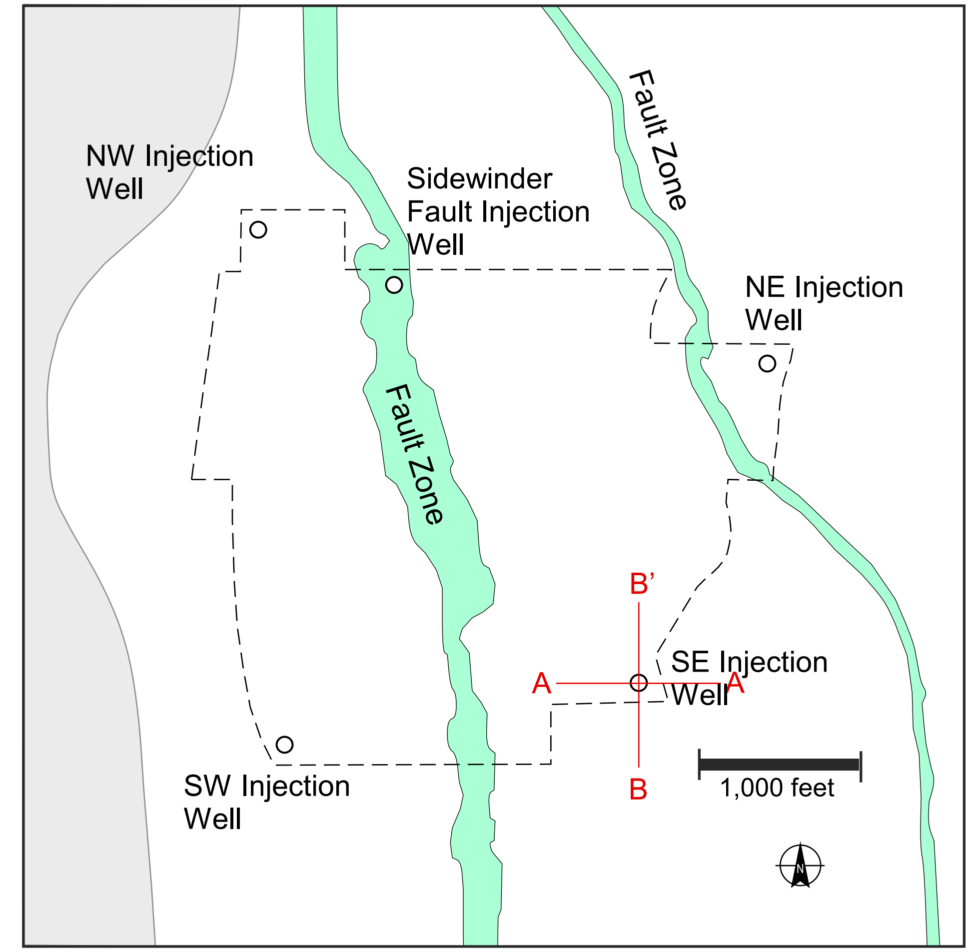
MARCH 2021

FIGURE 5





FAULT LOCATION MAP

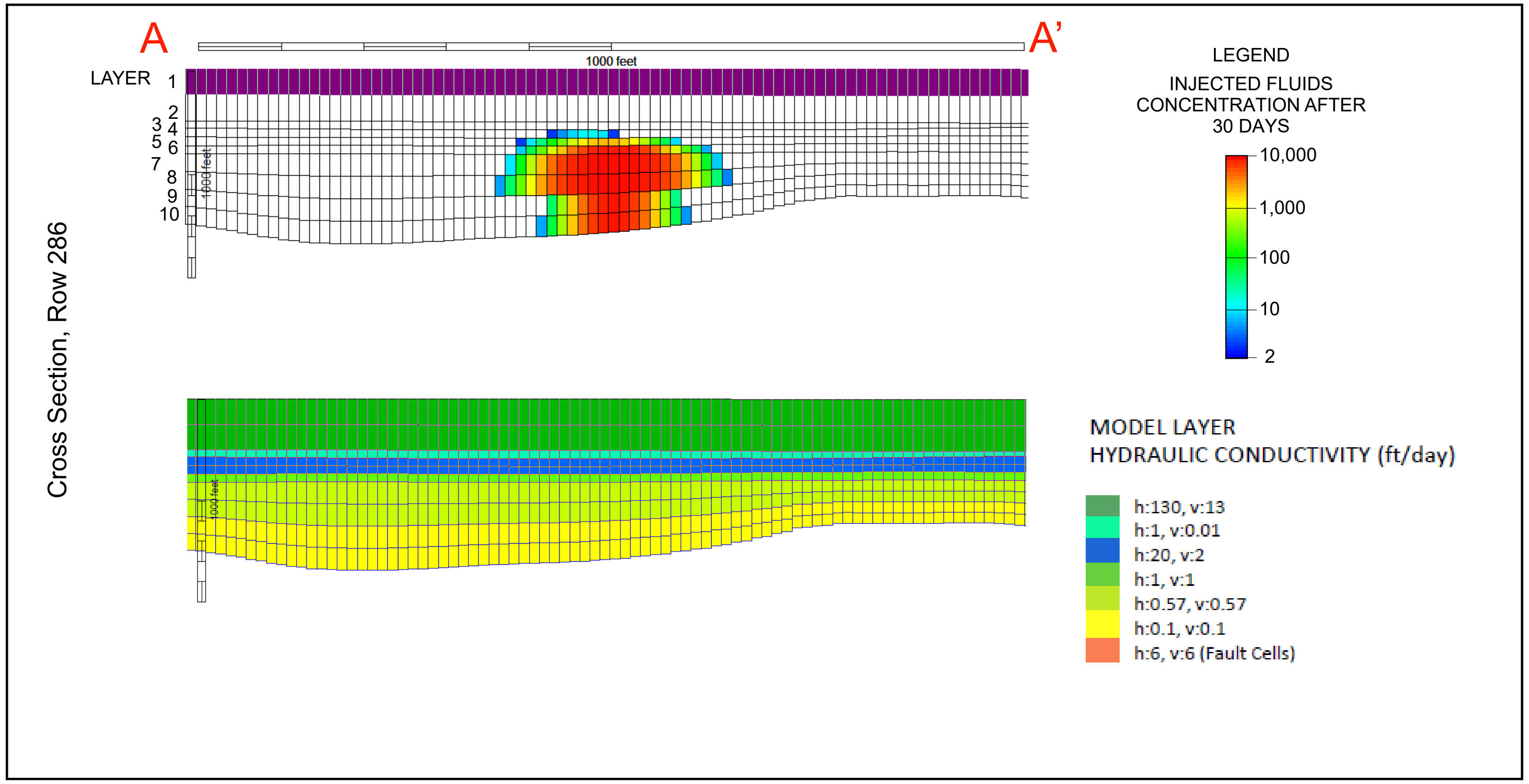


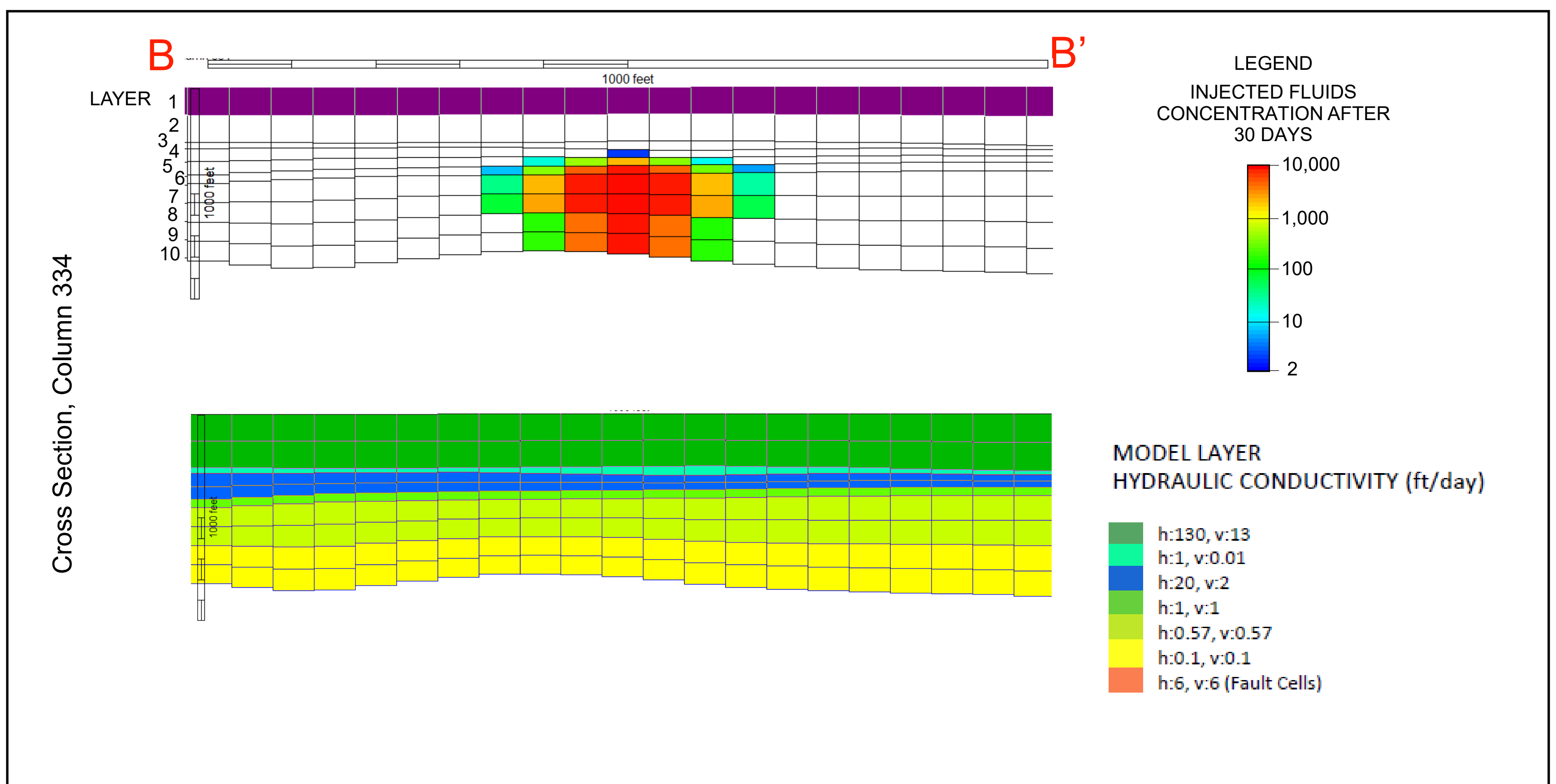
HALEY ALDRICH

CROSS SECTIONS
SE INJECTION WELL, 48 HOURS
INJECTION WITH NO EXTRACTION

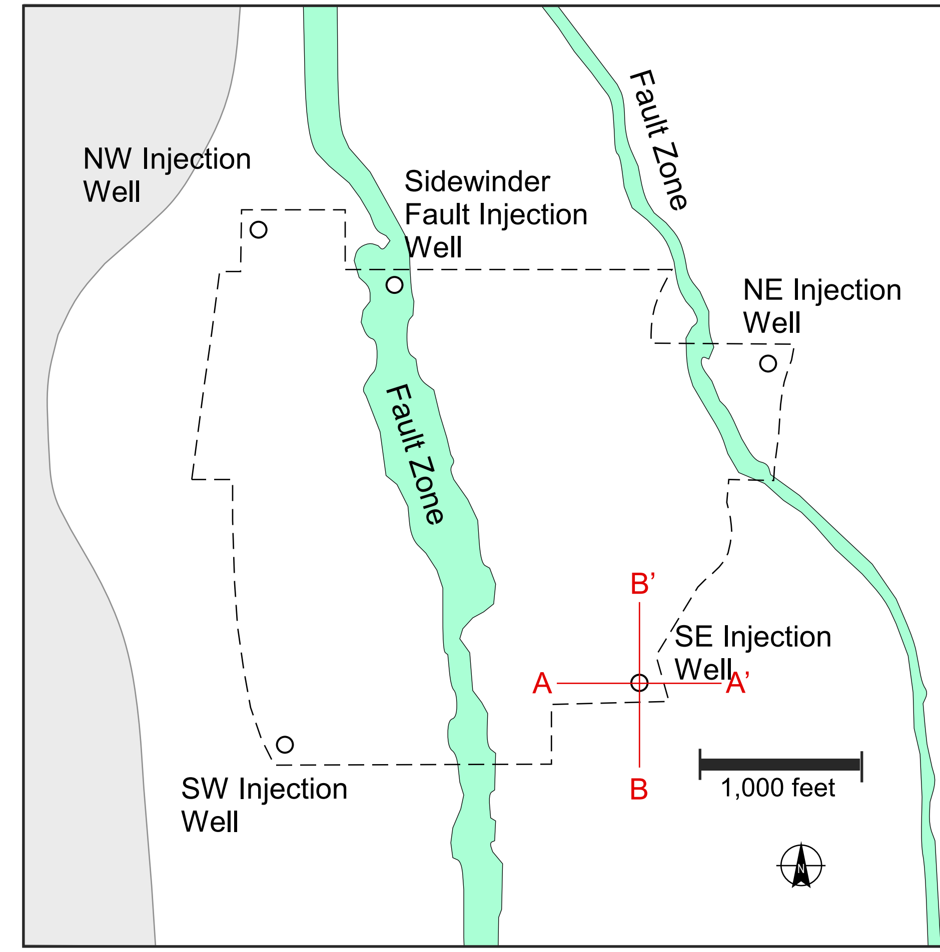
MARCH 2021

FIGURE 6





FAULT LOCATION MAP

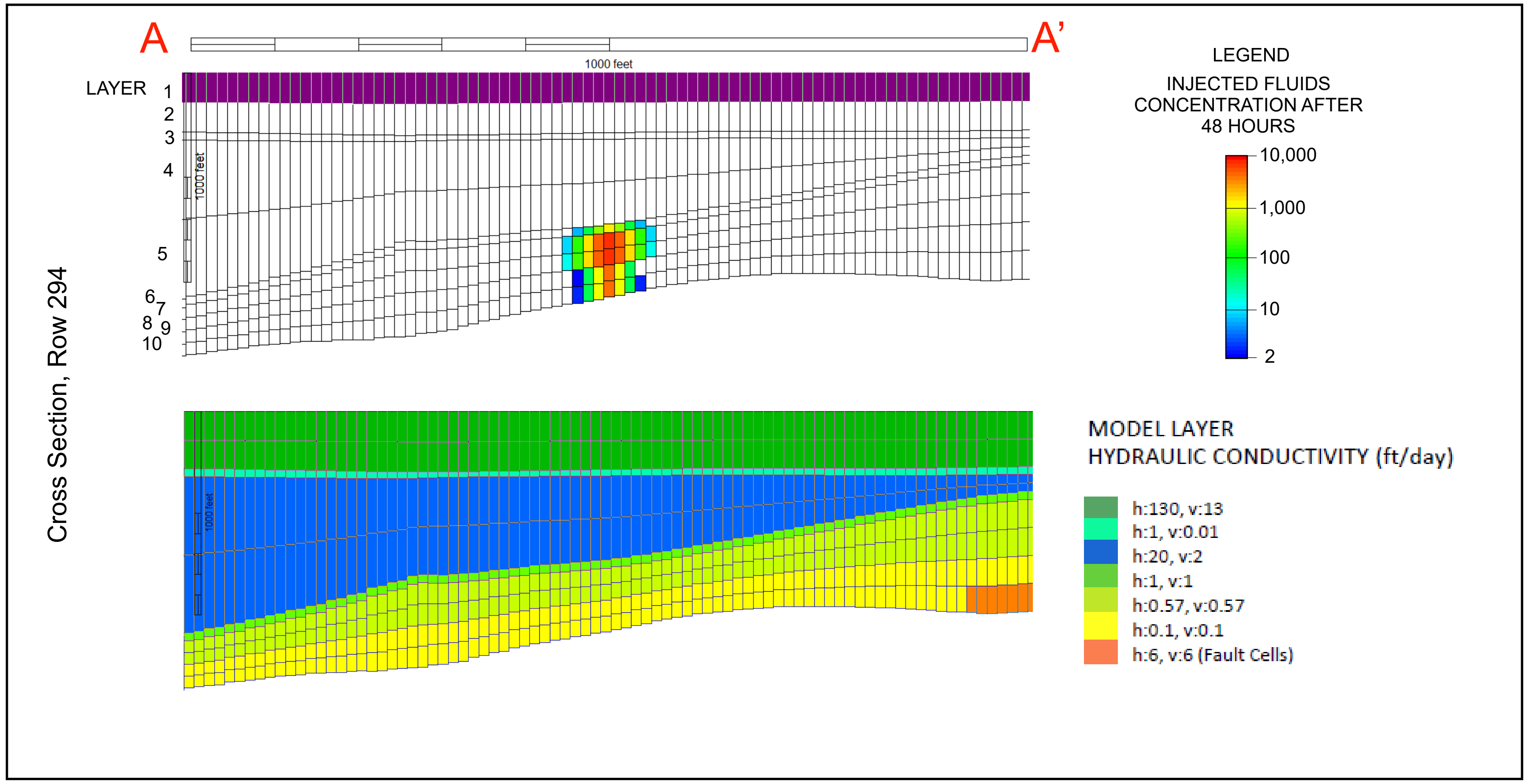


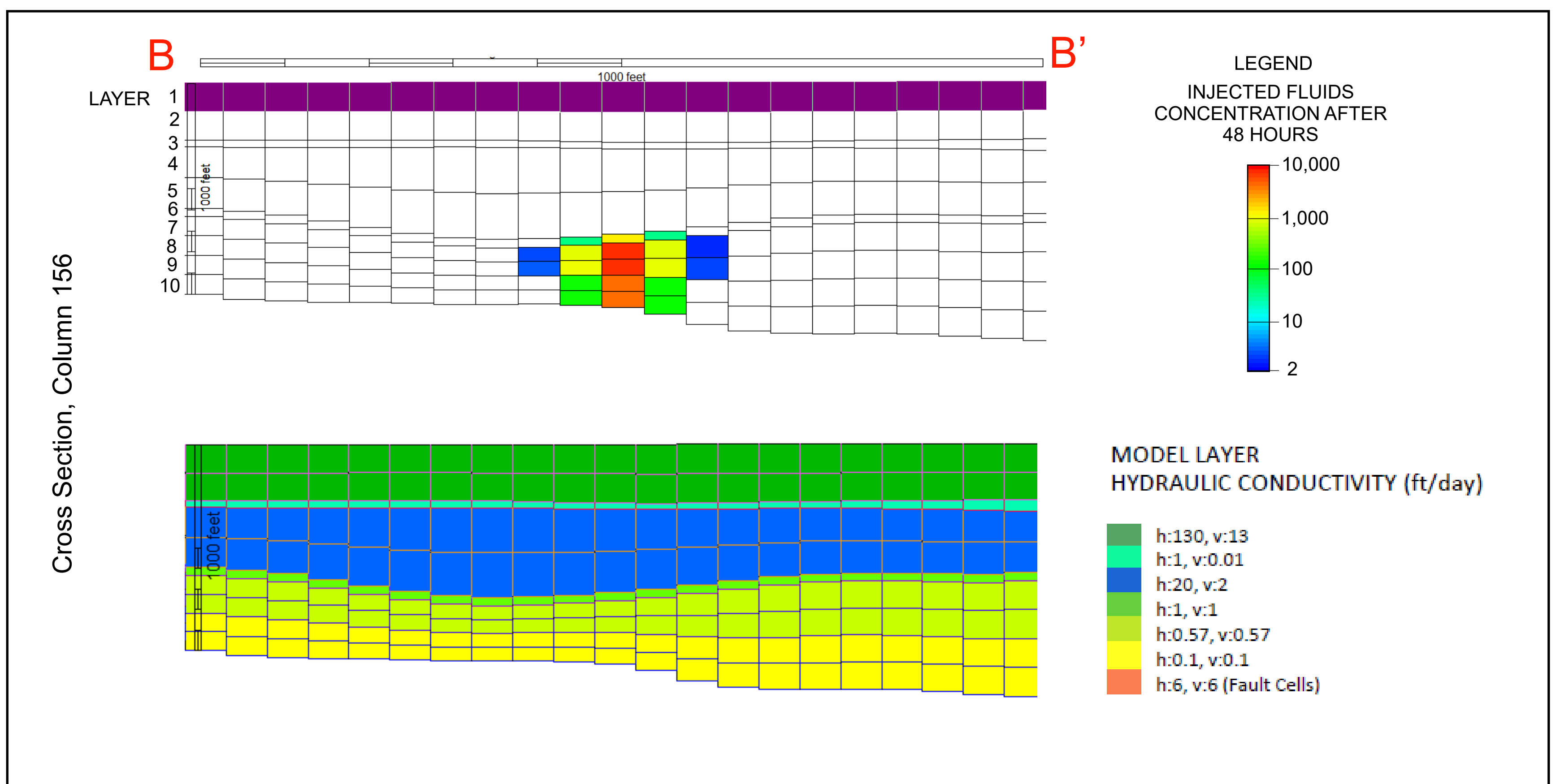
HALEY ALDRICH

CROSS SECTIONS
SE INJECTION WELL, 30 DAYS
INJECTION WITH NO EXTRACTION

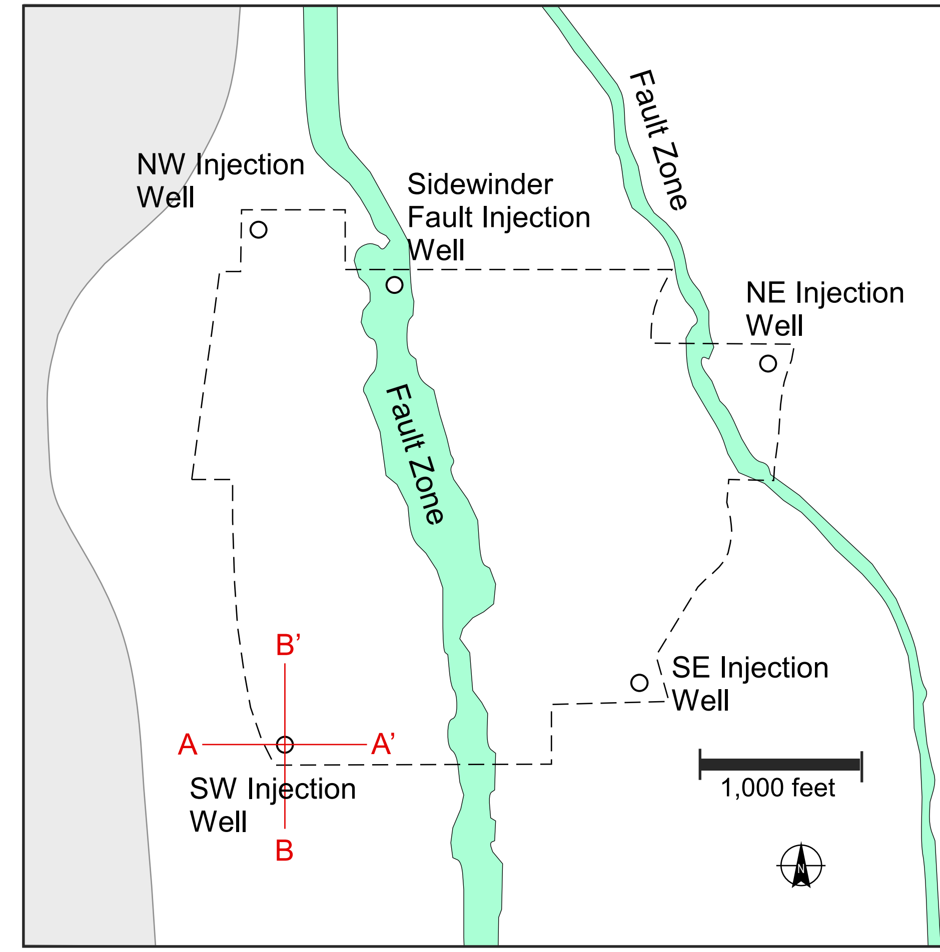
MARCH 2021

FIGURE 7





FAULT LOCATION MAP

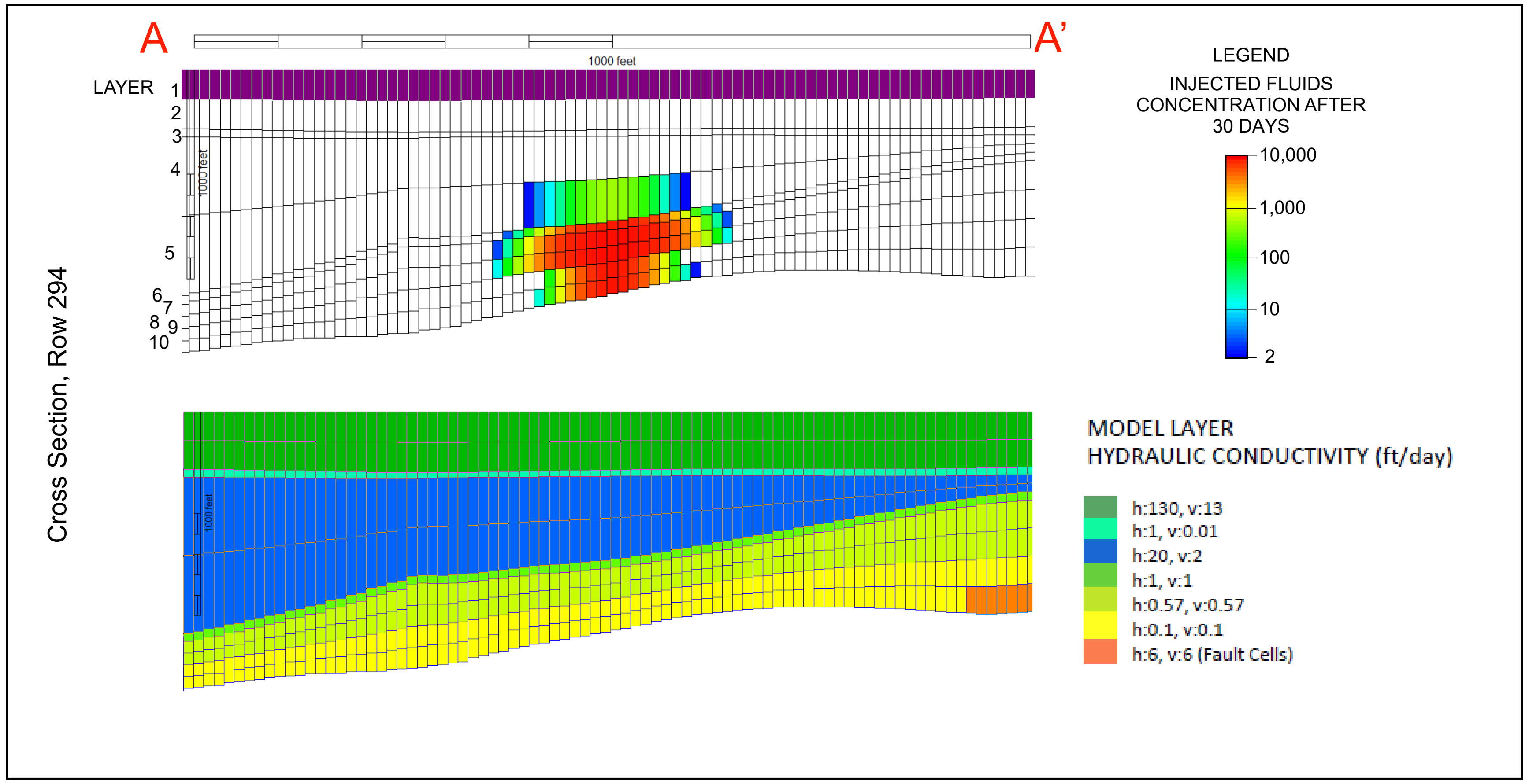


HALEY ALDRICH

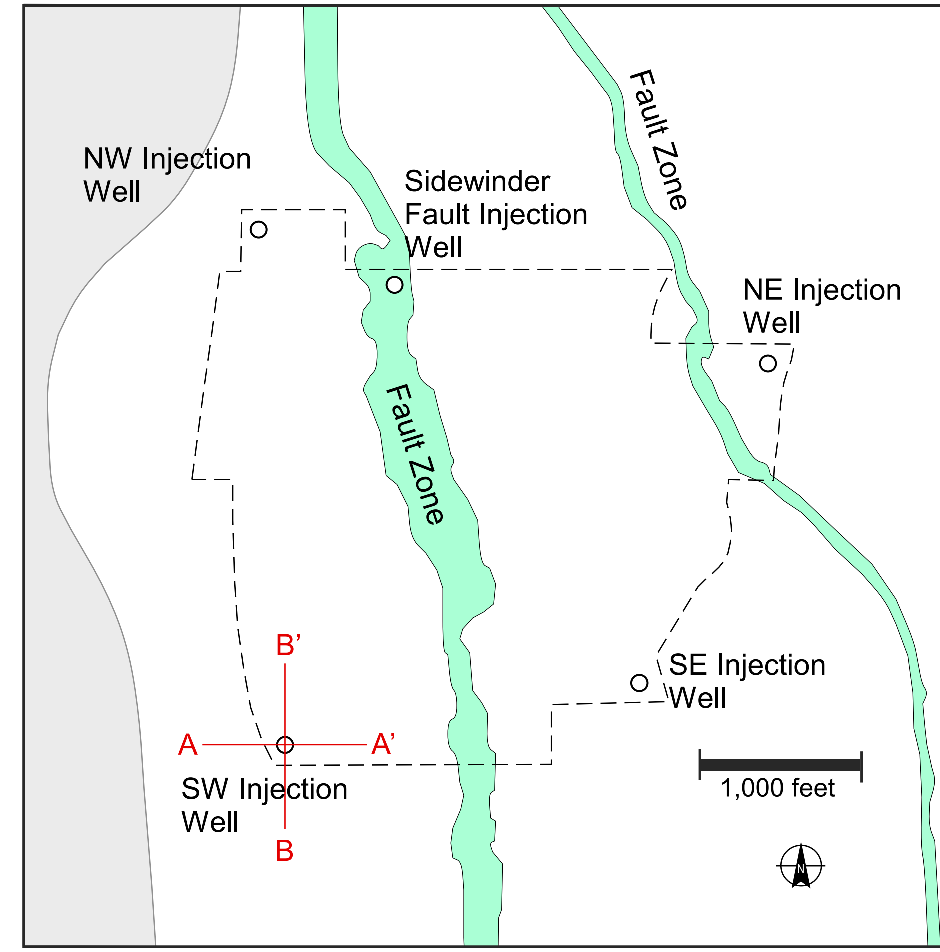
CROSS SECTIONS
SW INJECTION WELL, 48 HOURS
INJECTION WITH NO EXTRACTION

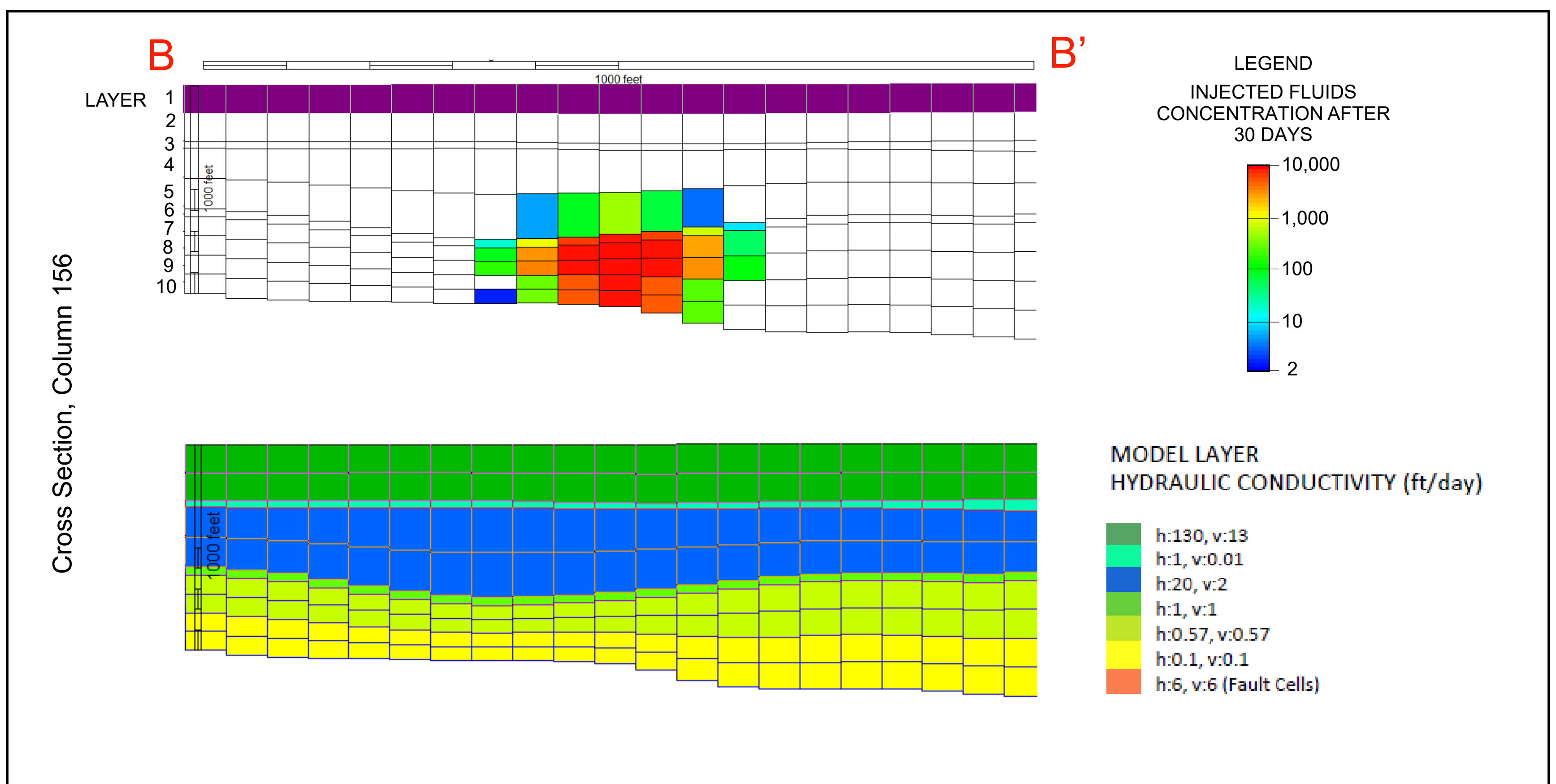
MARCH 2021

FIGURE 8



FAULT LOCATION MAP



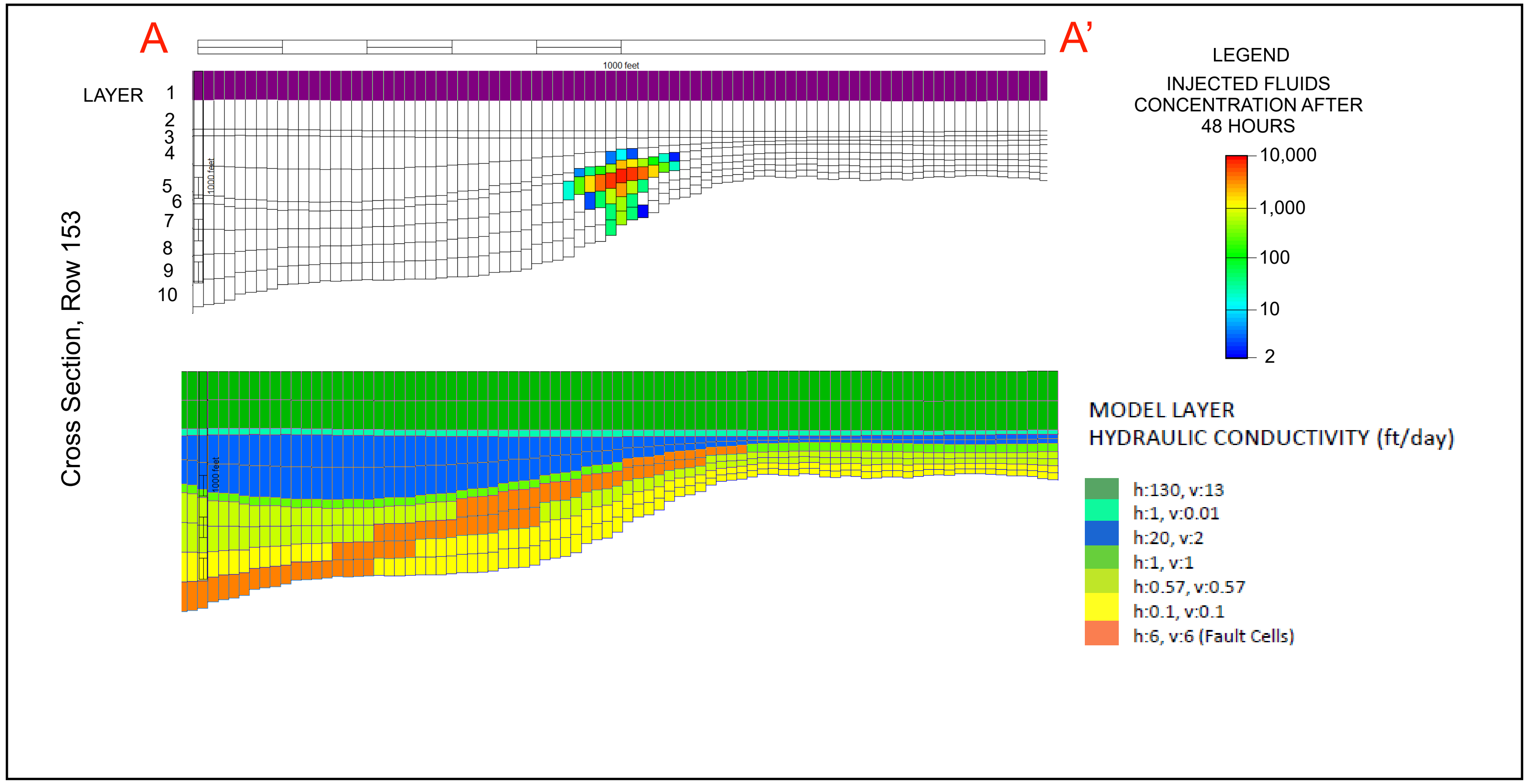


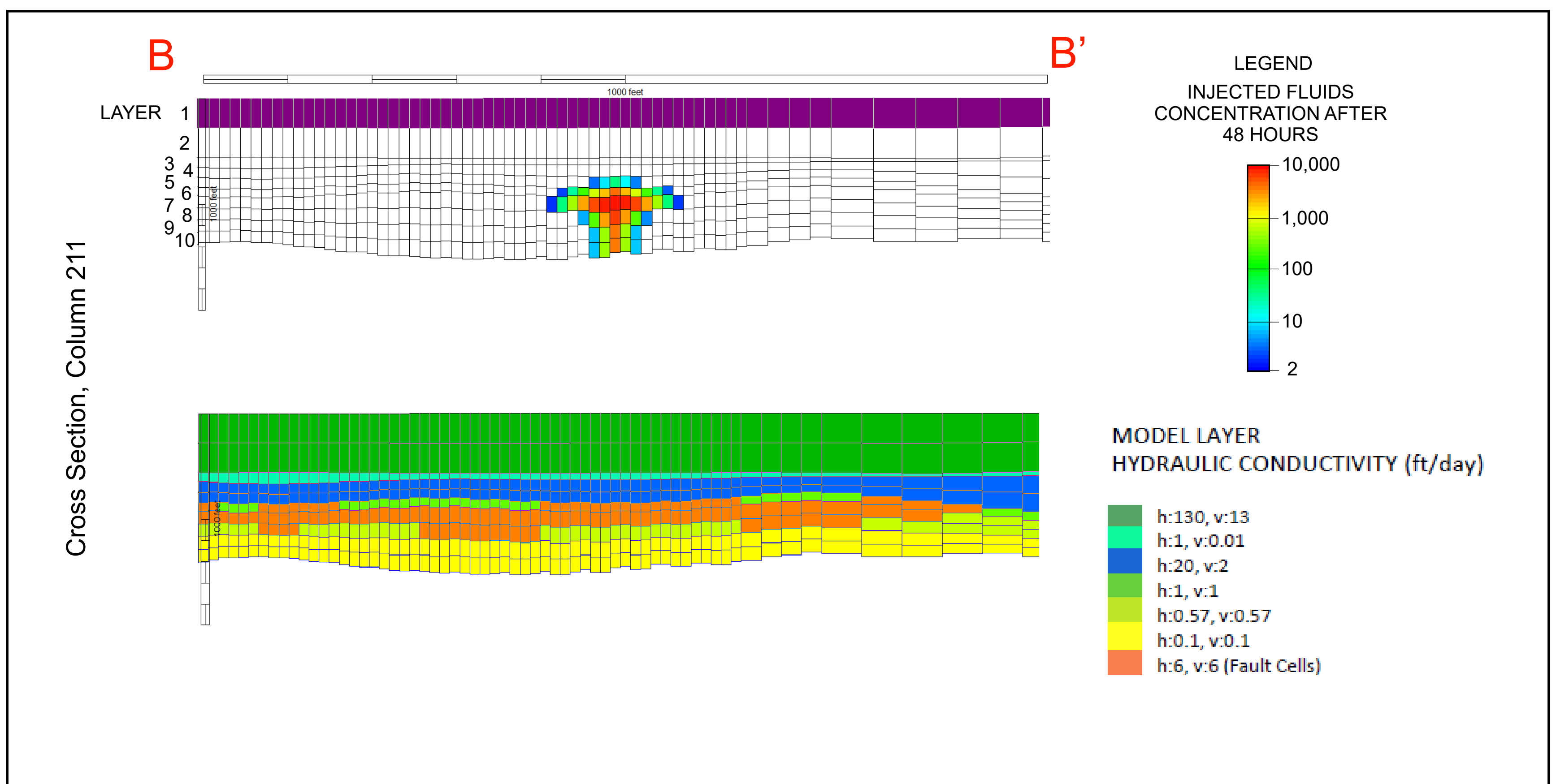
HALEY ALDRICH

CROSS SECTIONS
SW INJECTION WELL, 30 DAYS
INJECTION WITH NO EXTRACTION

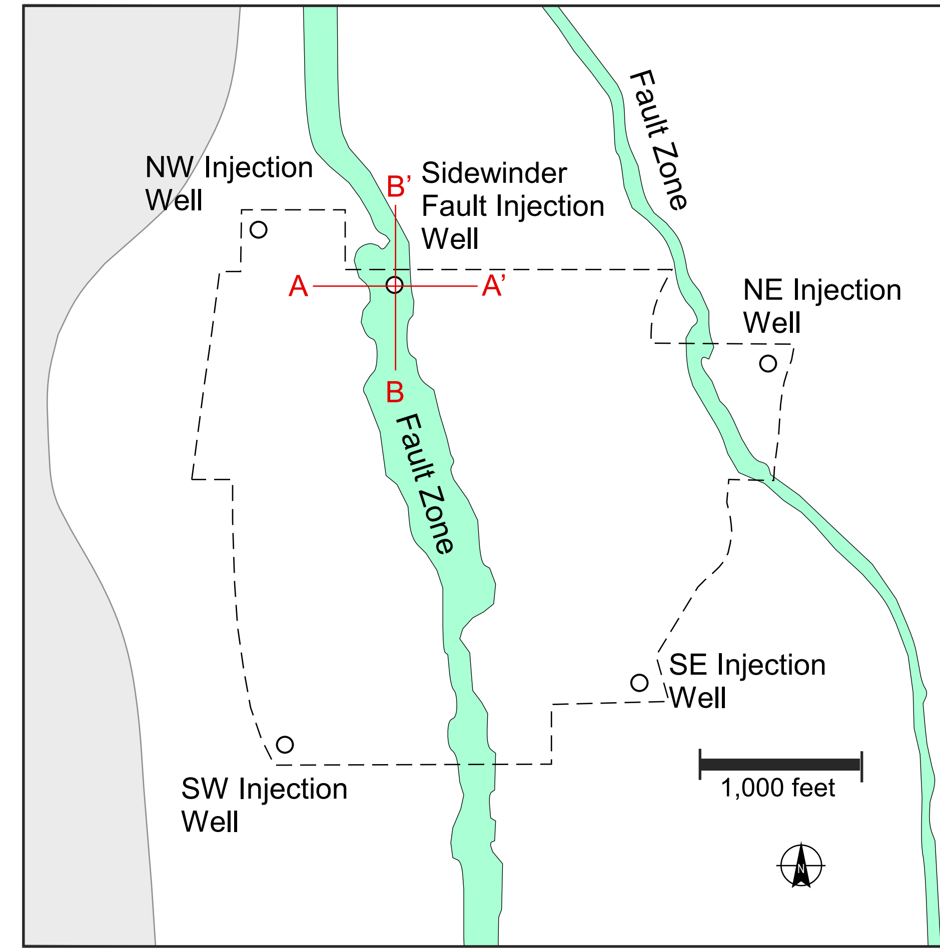
MARCH 2021

FIGURE 9





FAULT LOCATION MAP

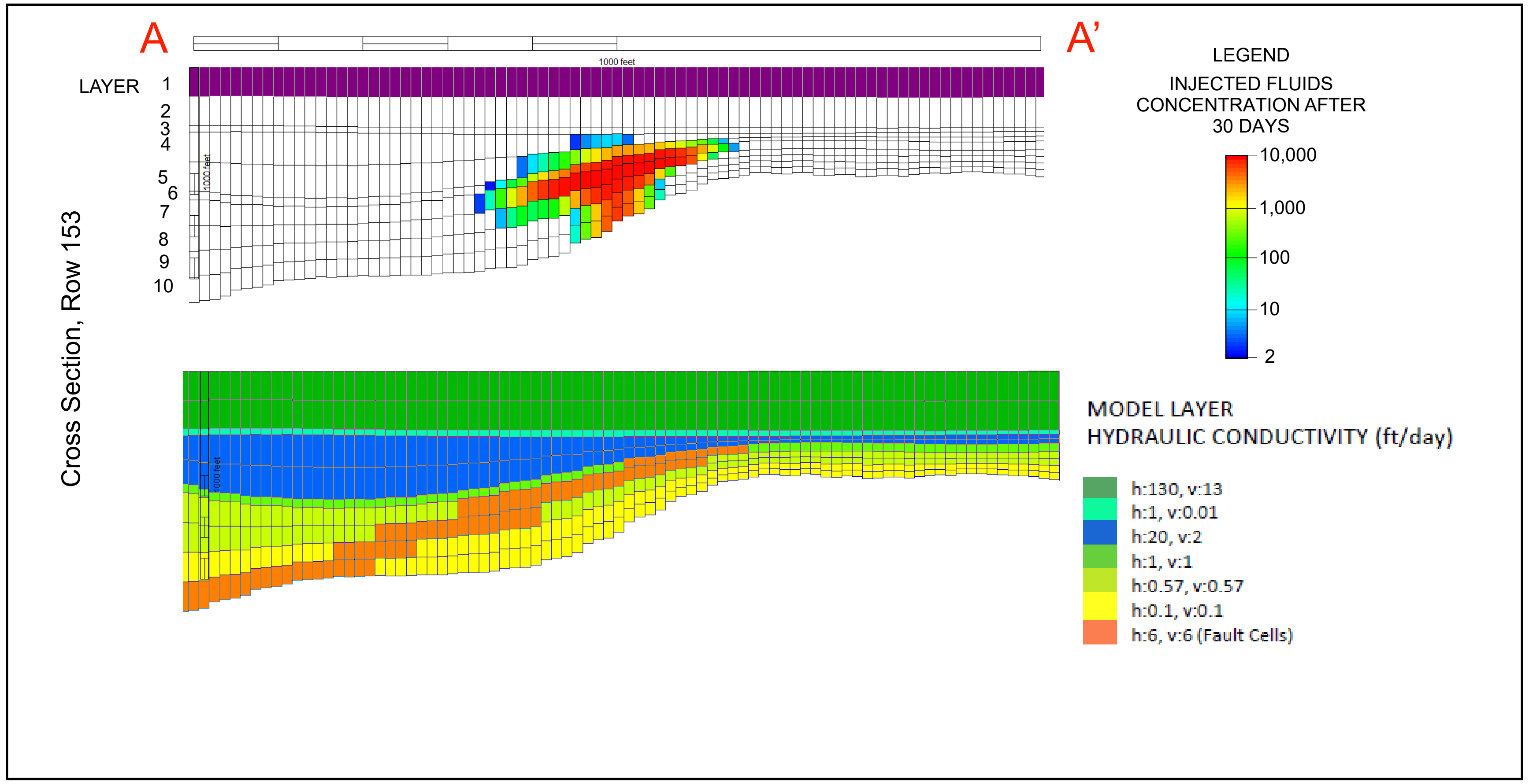


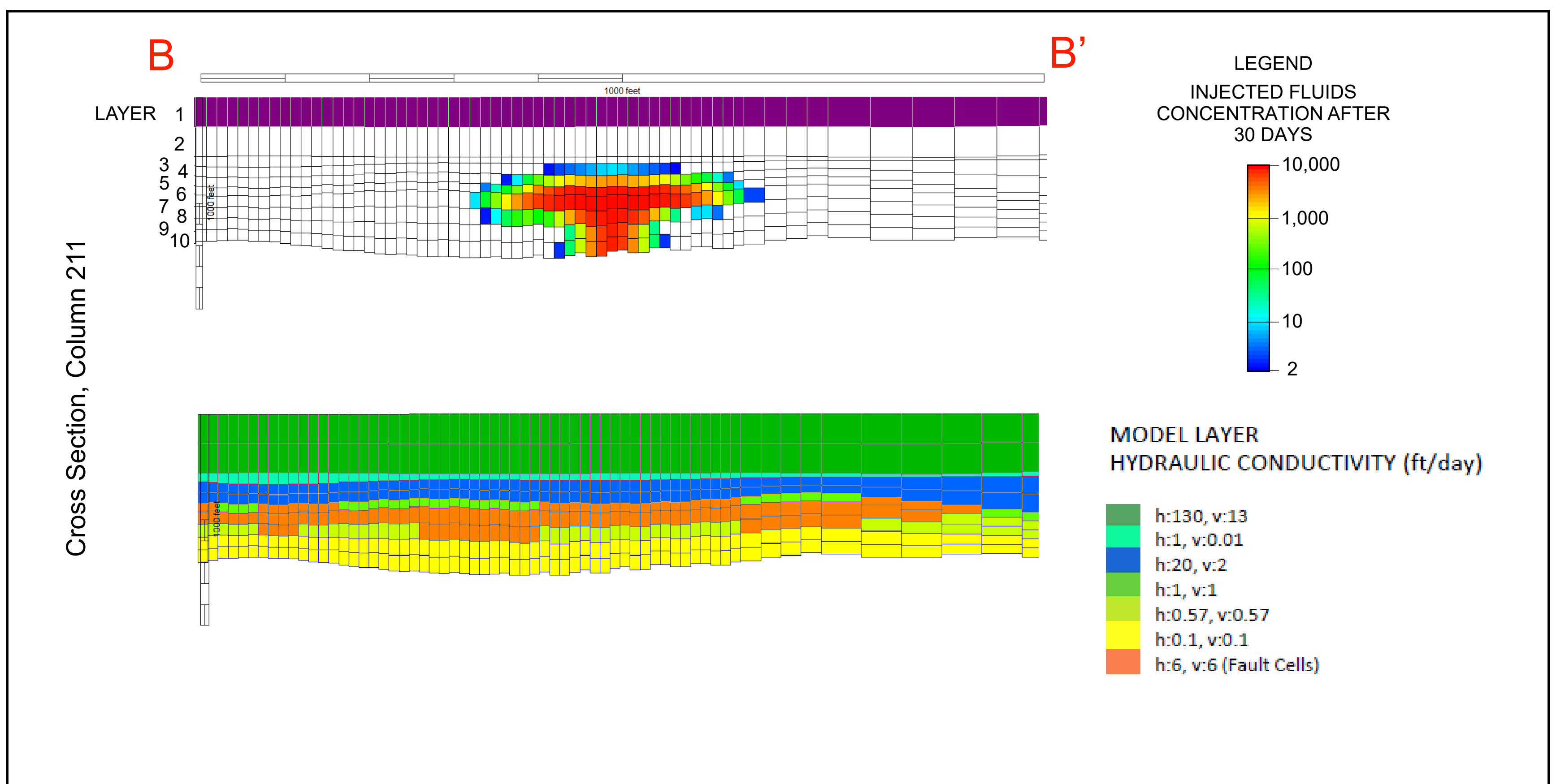
HALEY ALDRICH

CROSS SECTIONS
SIDEWINDER FAULT INJECTION WELL, 48 HOUR INJECTION WITH NO EXTRACTION

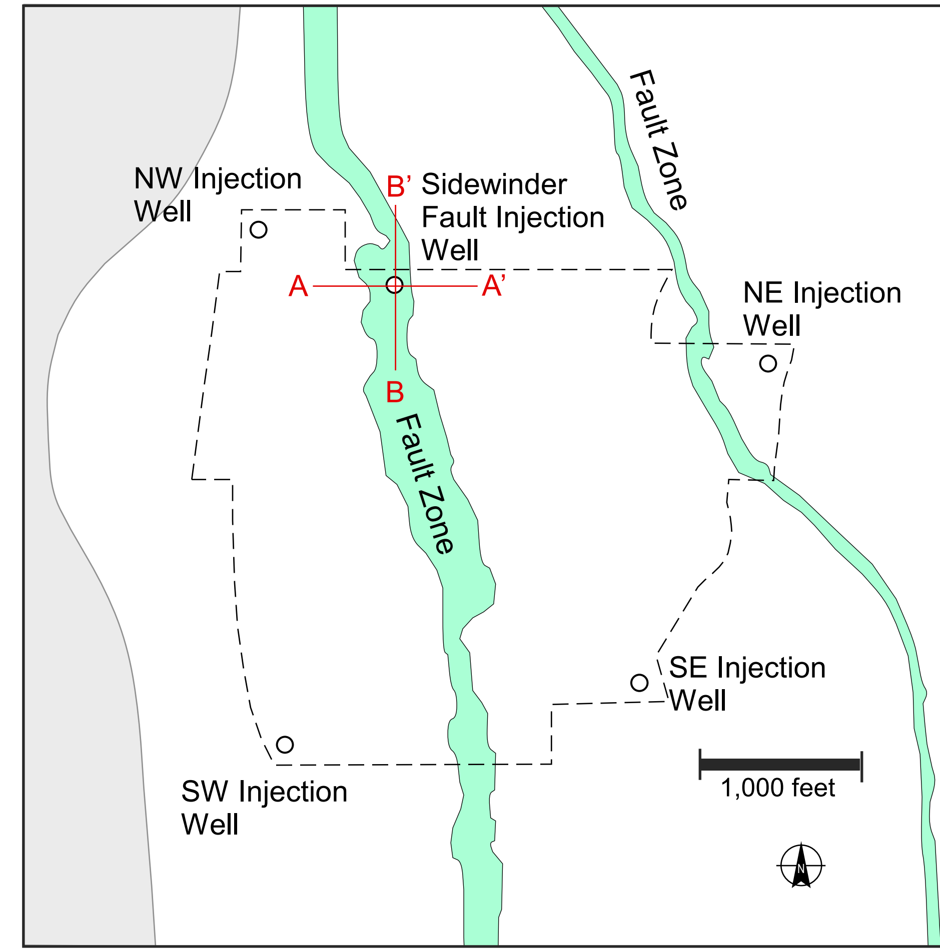
MARCH 2021

FIGURE 10





FAULT LOCATION MAP

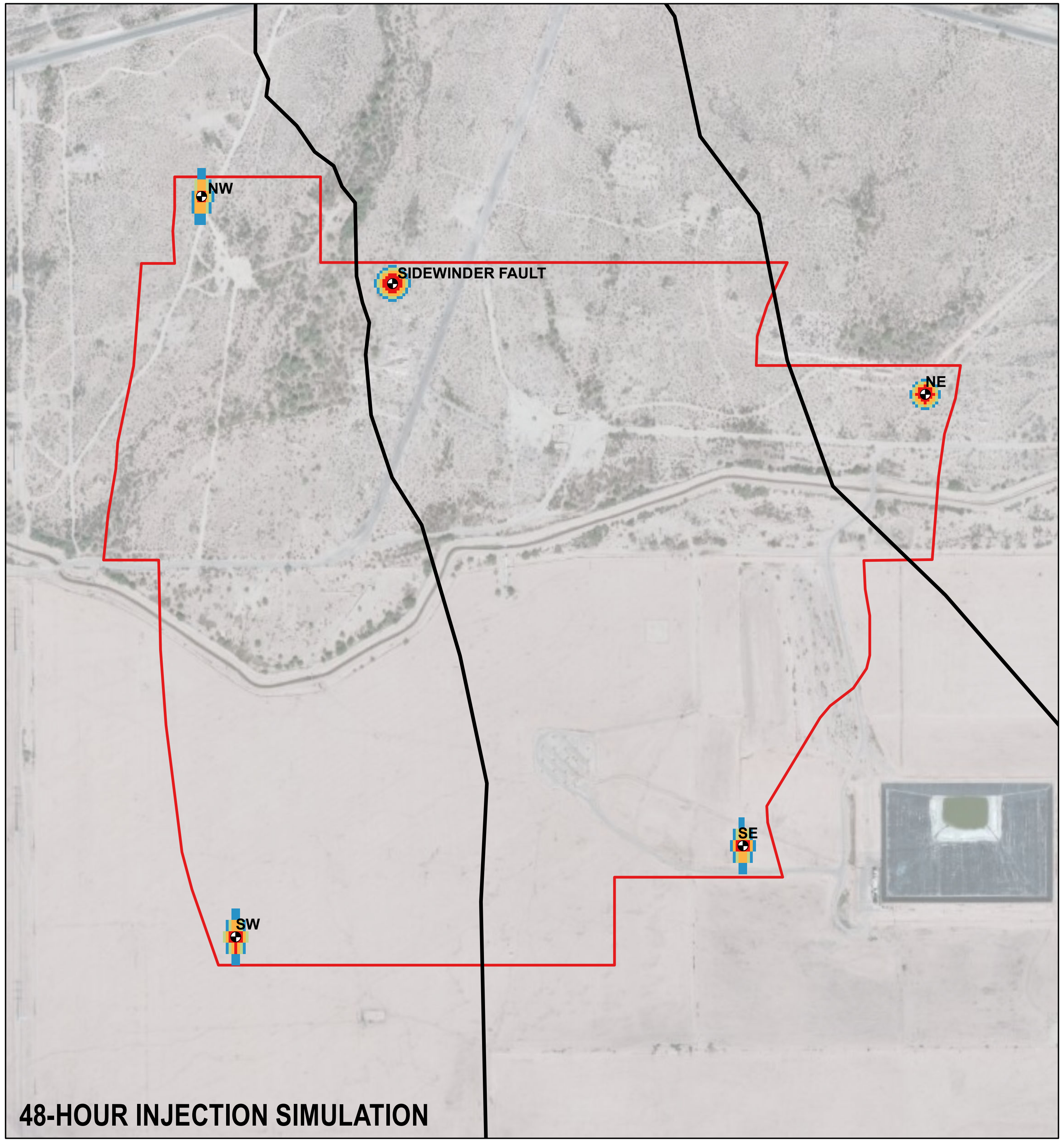


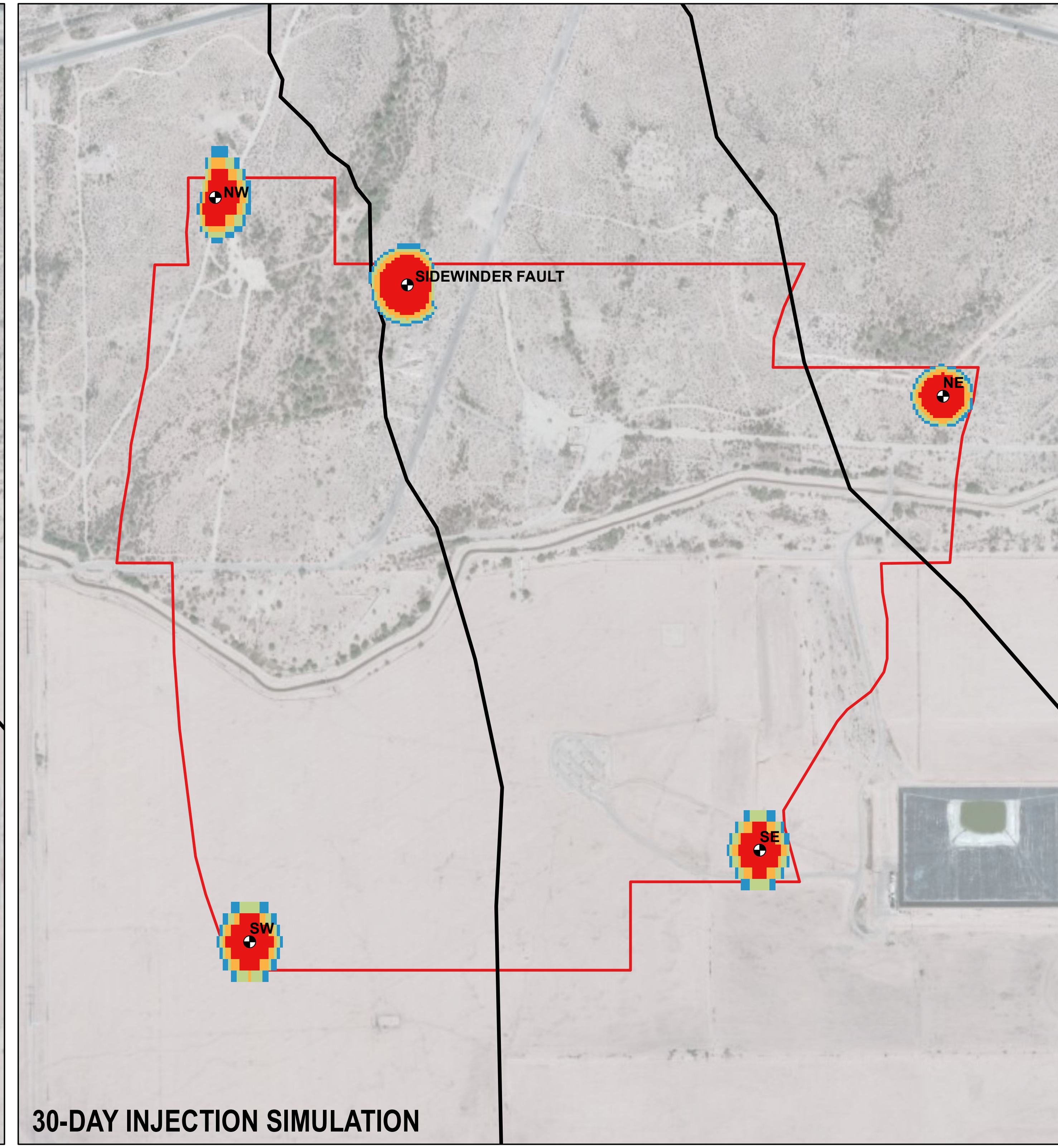
HALEY ALDRICH

CROSS SECTIONS
SIDEWINDER FAULT INJECTION WELL, 30 DAY INJECTION WITH NO EXTRACTION

MARCH 2021

FIGURE 11





LEGEND

- INJECTION WELL
- FAULT
- ISCR WELLFIELD

SOLUTE CONCENTRATION IN MILLIGRAMS PER LITER (mg/L)

- 1 TO 10
- 10 TO 100
- 100 TO 1000
- 1000 TO 10000

NOTES

1. ALL LOCATIONS AND DIMENTIONS ARE APPROXIMATE.
2. SIMULATED SOLUTE CONCENTRATIONS ARE FROM MODEL LAYER 7, EXCEPT THE NW INJECTION WELL WHICH USED MODEL LAYER 10.
3. AERIAL IMAGERY SOURCE: ESRI

N

0 600 1,200

SCALE IN FEET

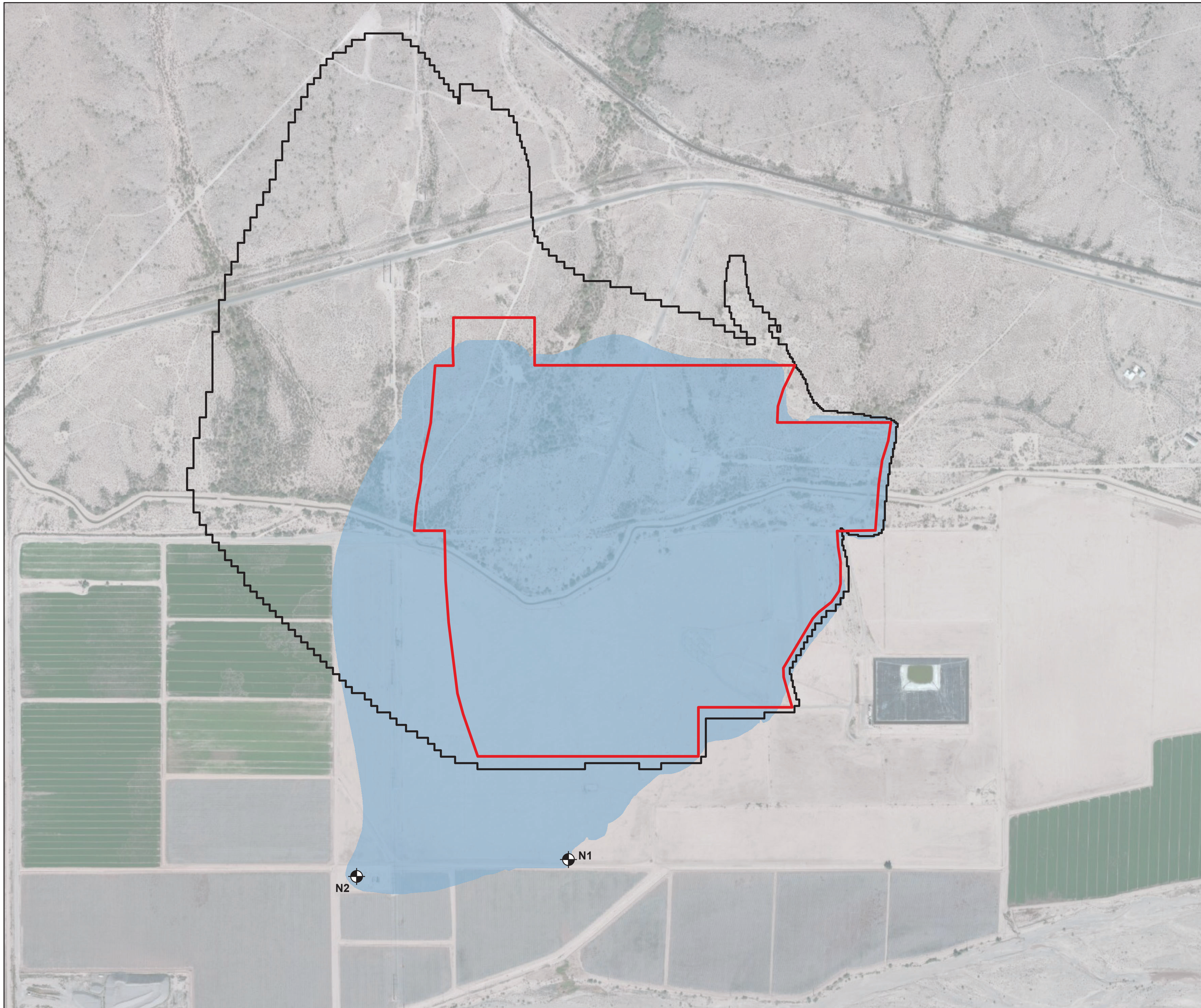
HALEY ALDRICH

FLORENCE COPPPER, INC.
FLORENCE, ARIZONA

PLAN VIEW OF MAXIMUM EXTENT OF MIGRATION DURING 48-HOUR AND 30-DAY INJECTION SCENARIOS WITHOUT HYDRAULIC CONTROL PUMPING

MARCH 2021

FIGURE 12



LEGEND

NEW IRRIGATION WELL

EXISTING WELL

ISCR WELL FIELD

EXTENT OF SOLUTE MIGRATION WITHOUT WELLS N1, N2, BIA-9R AND WW4 PUMPING

EXTENT OF SOLUTE MIGRATION WITH WELLS N1, N2, BIA-9R AND WW4 PUMPING

NOTES

1. ALL LOCATIONS AND DIMENSIONS ARE APPROXIMATE
2. AERIAL IMAGERY SOURCE: ESRI

0 800 1,600

SCALE IN FEET

HALEY ALDRICH

FLORENCE COPPER, INC.
FLORENCE, ARIZONA

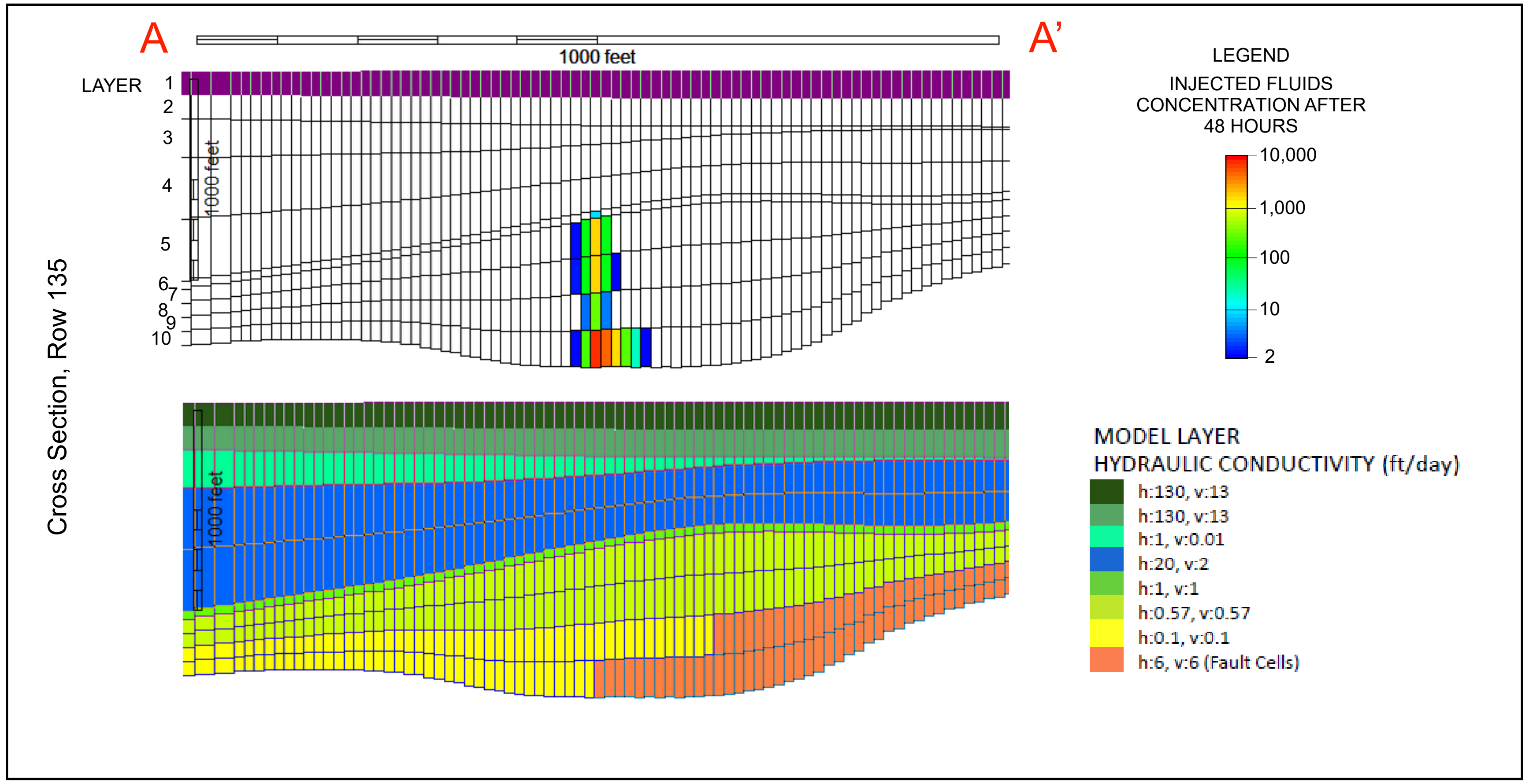
DISCHARGE IMPACT AREA 30 YEARS AFTER CLOSURE WITH NEW IRRIGATION WELLS PUMPING

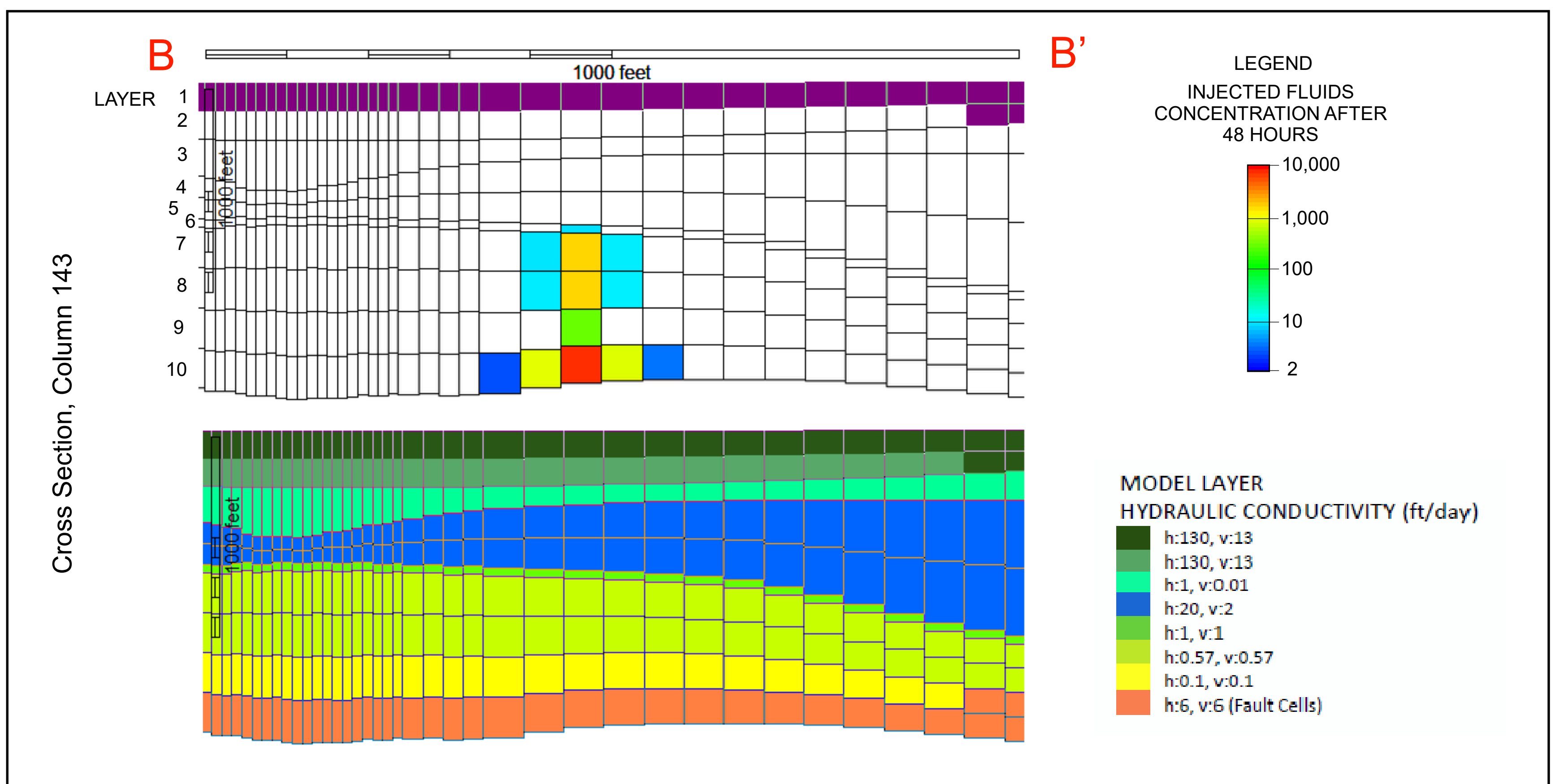
MARCH 2021

FIGURE 13

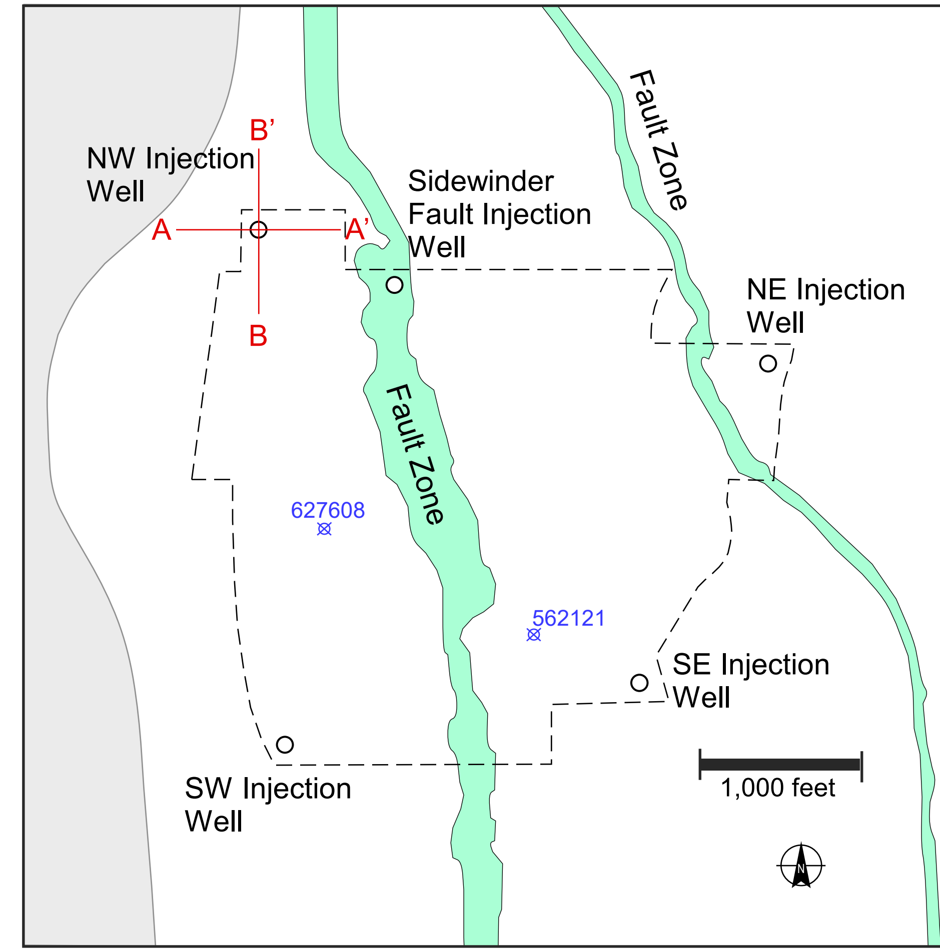
EXHIBIT A-8-1

Figures A-4 through A-13
of the 4 October 2019 UIC Permit Application





FAULT LOCATION MAP

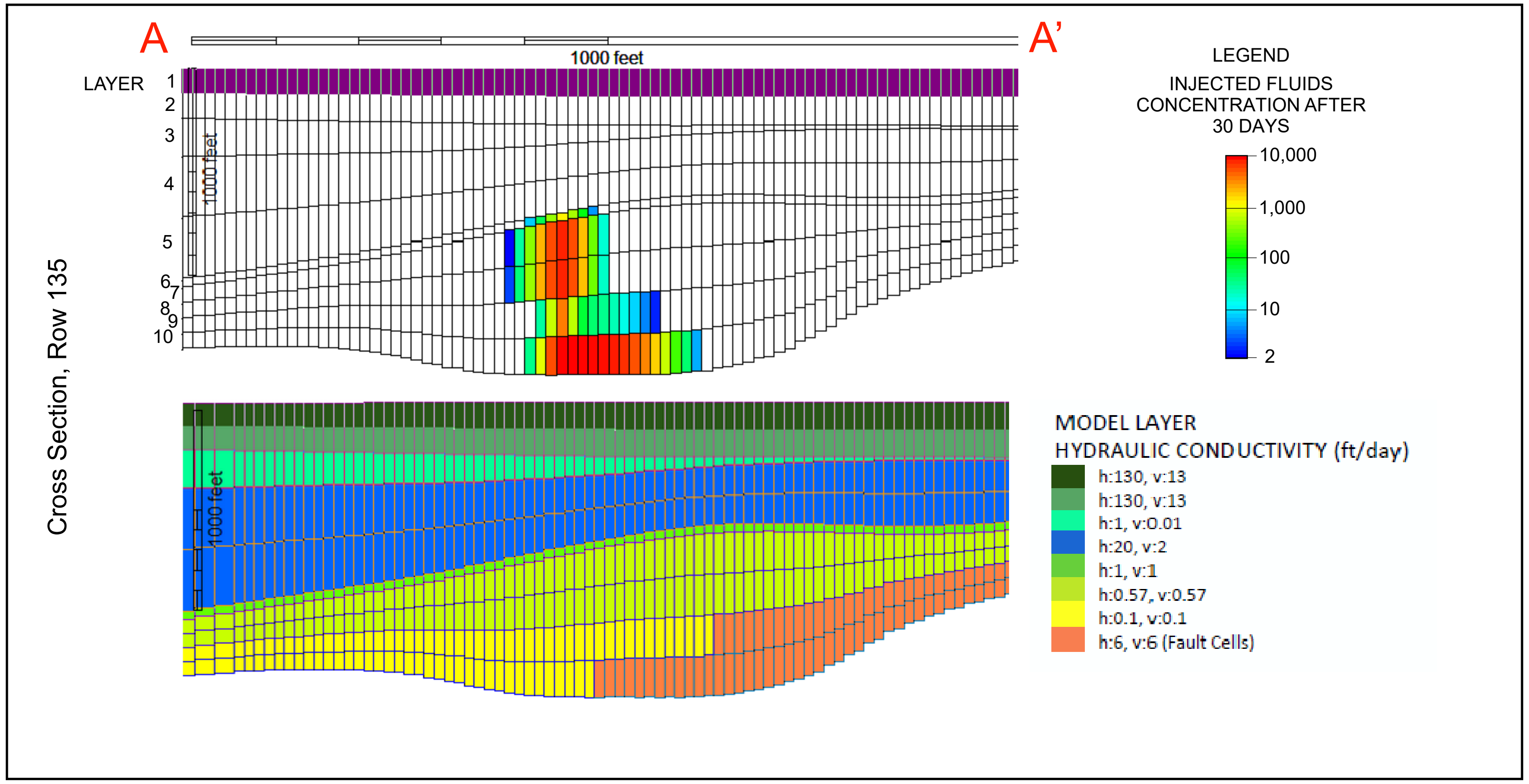


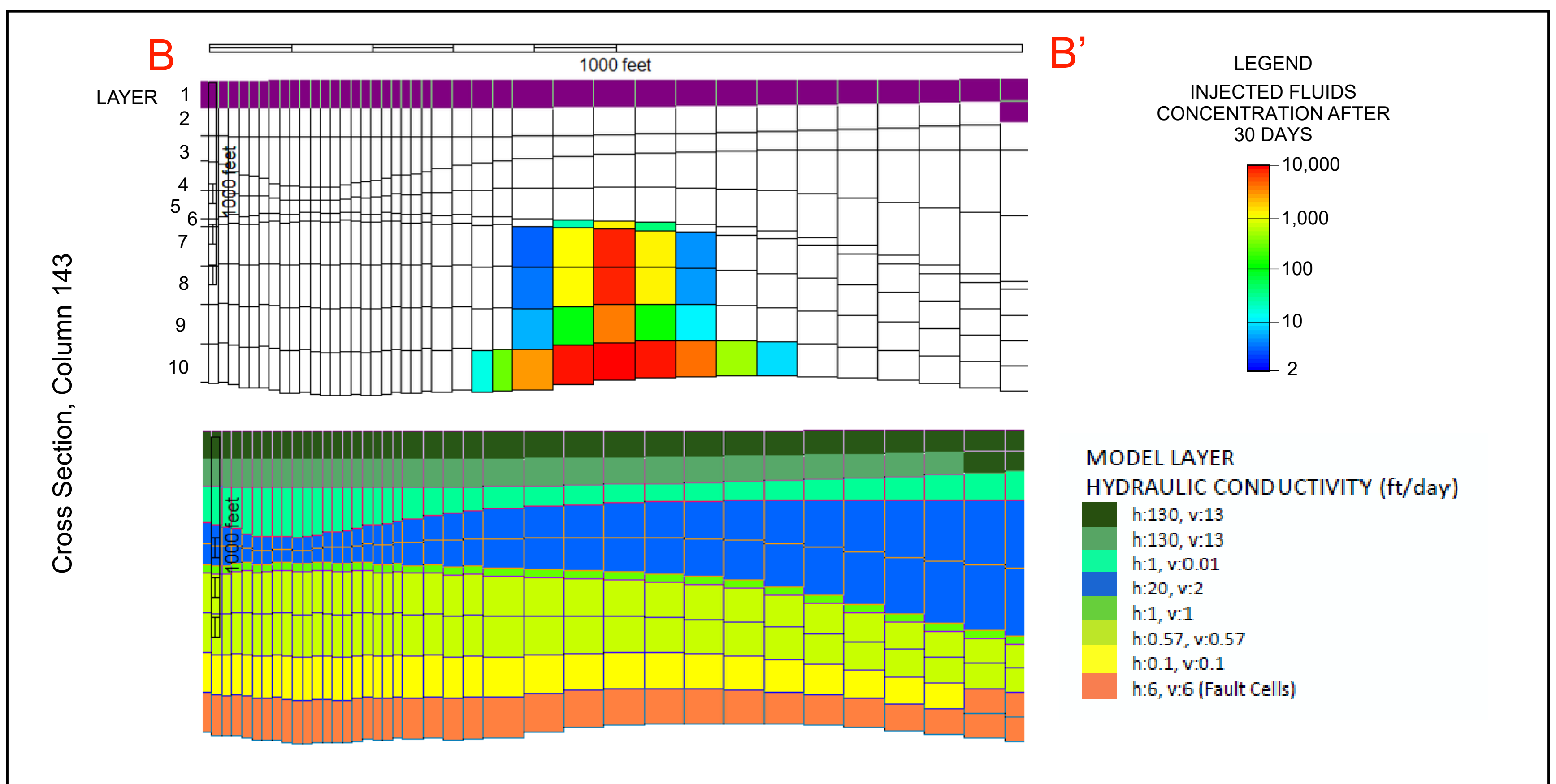
HALEY ALDRICH

CROSS SECTIONS
NW INJECTION WELL, 48 HOURS
INJECTION WITH NO EXTRACTION

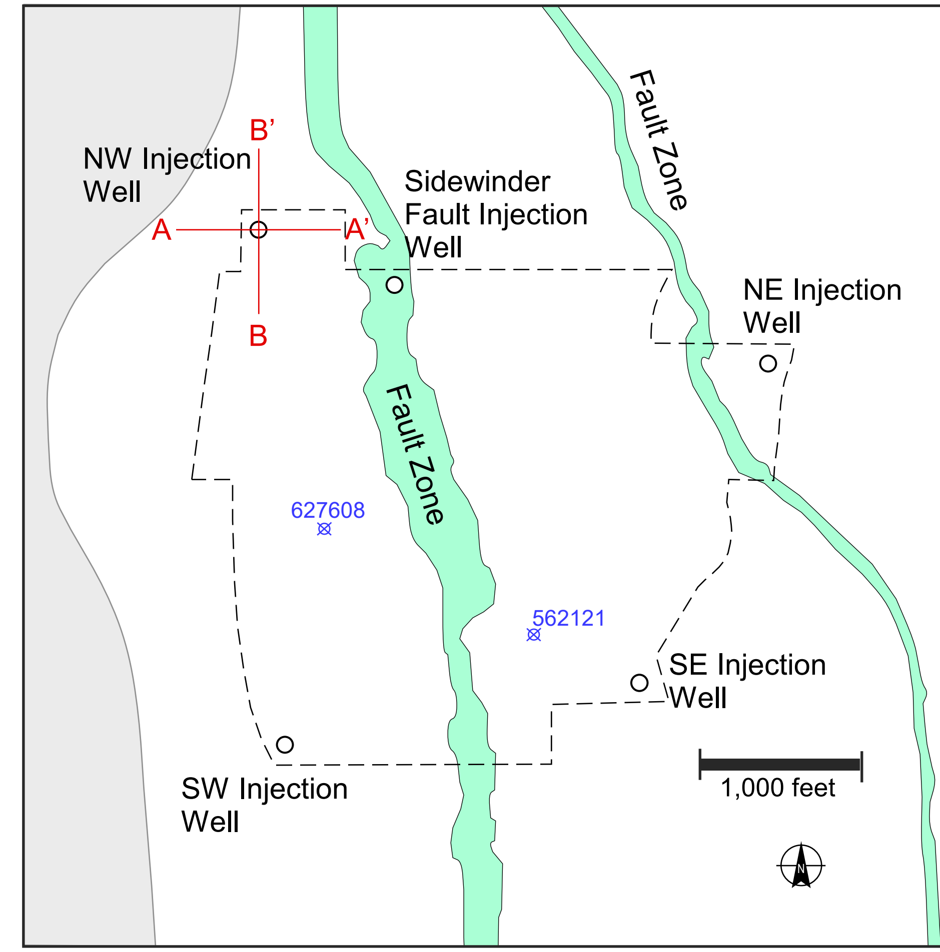
FEBRUARY 2019
REVISED FEBRUARY 2020

FIGURE A-4





FAULT LOCATION MAP

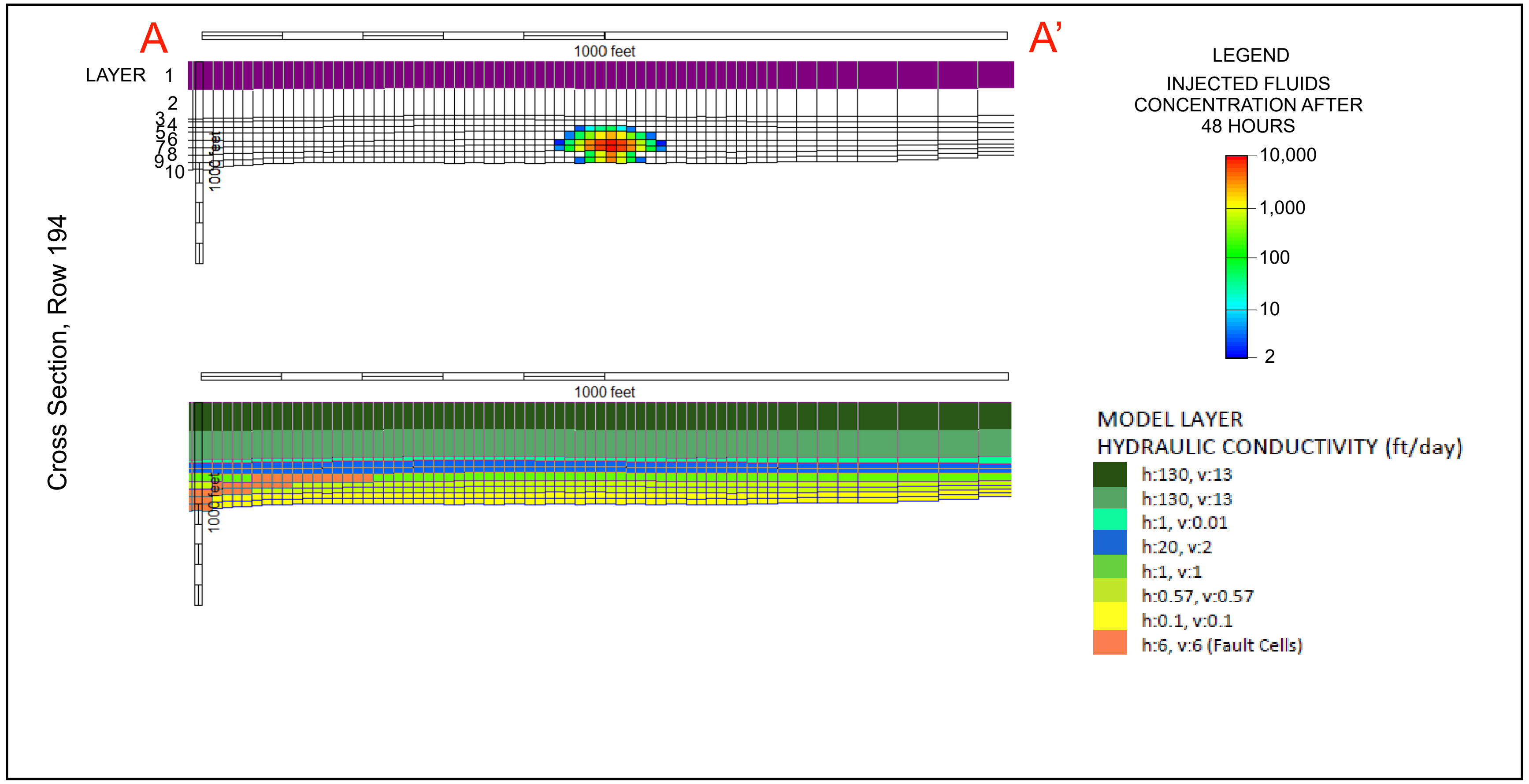


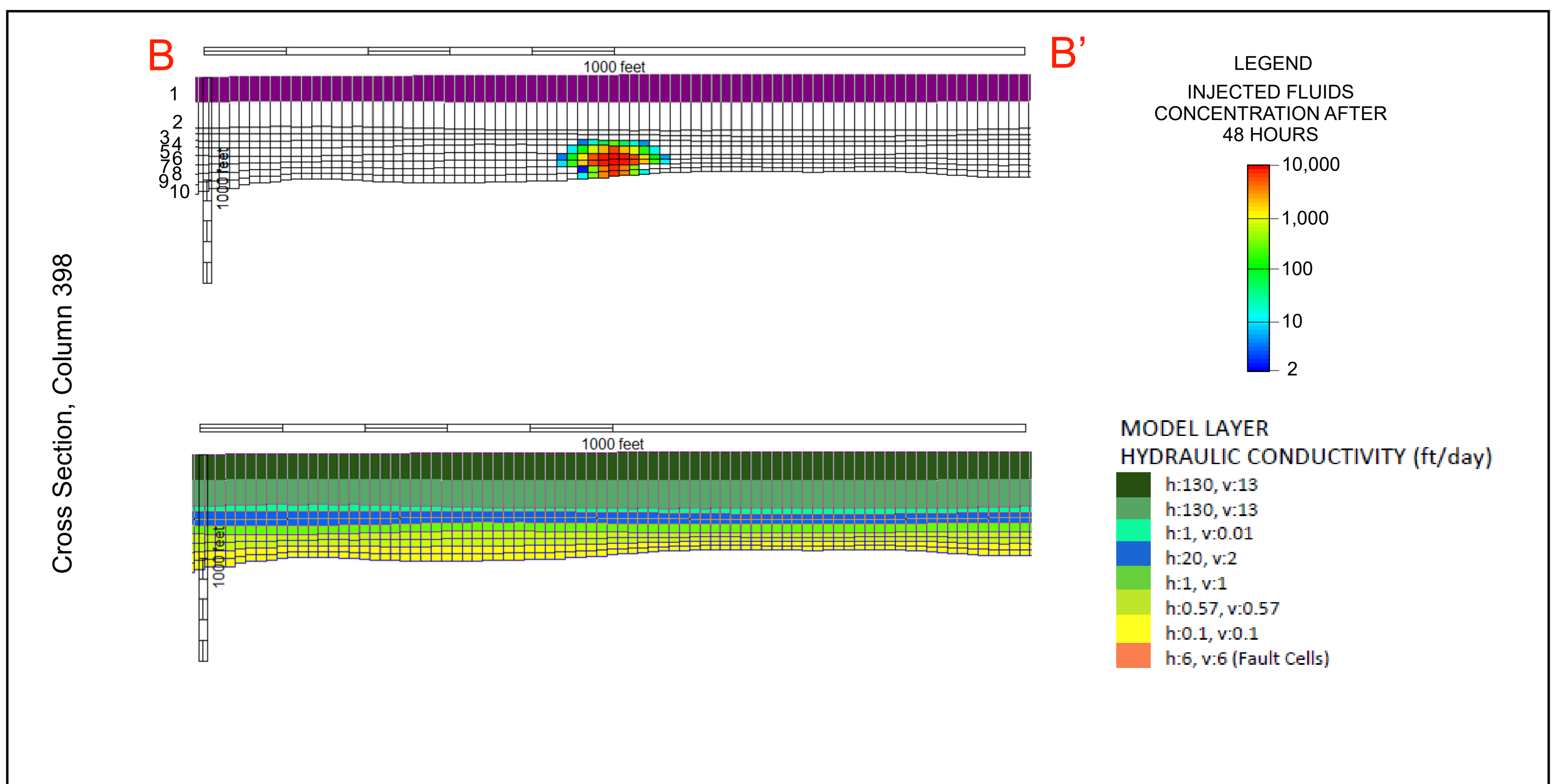
HALEY ALDRICH

CROSS SECTIONS
NW INJECTION WELL, 30 DAYS
INJECTION WITH NO EXTRACTION

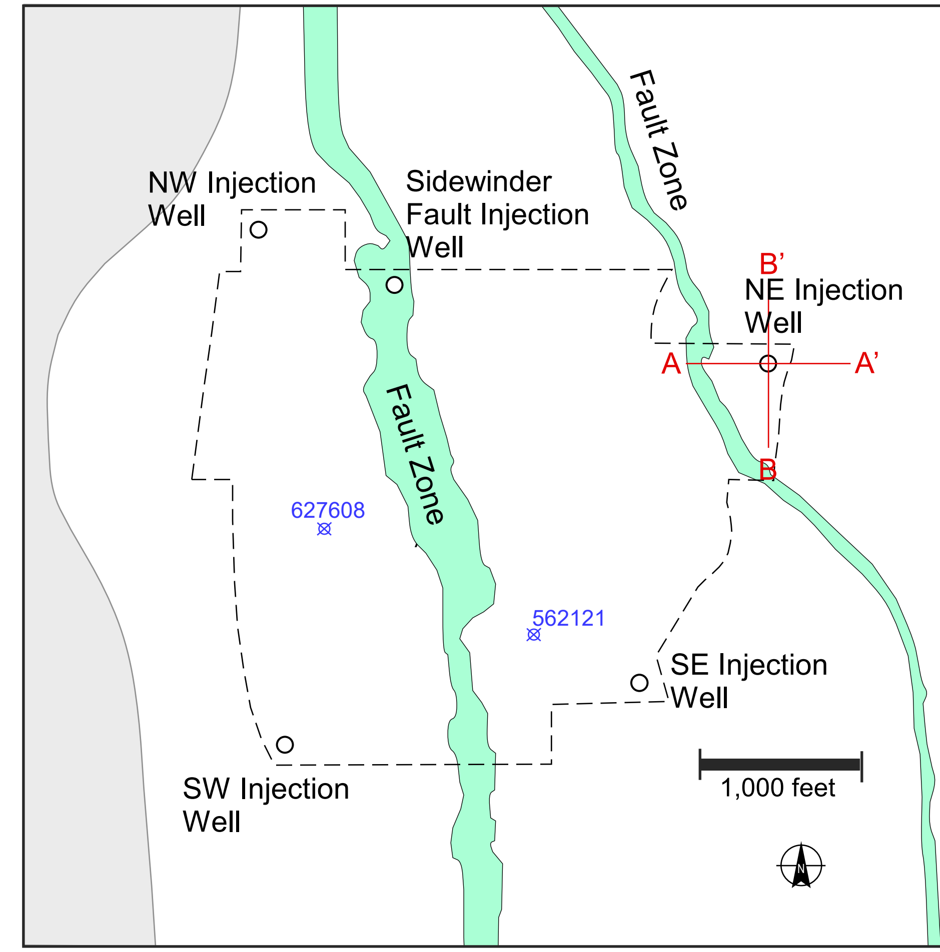
FEBRUARY 2019
REVISED FEBRUARY 2020

FIGURE A-5





FAULT LOCATION MAP

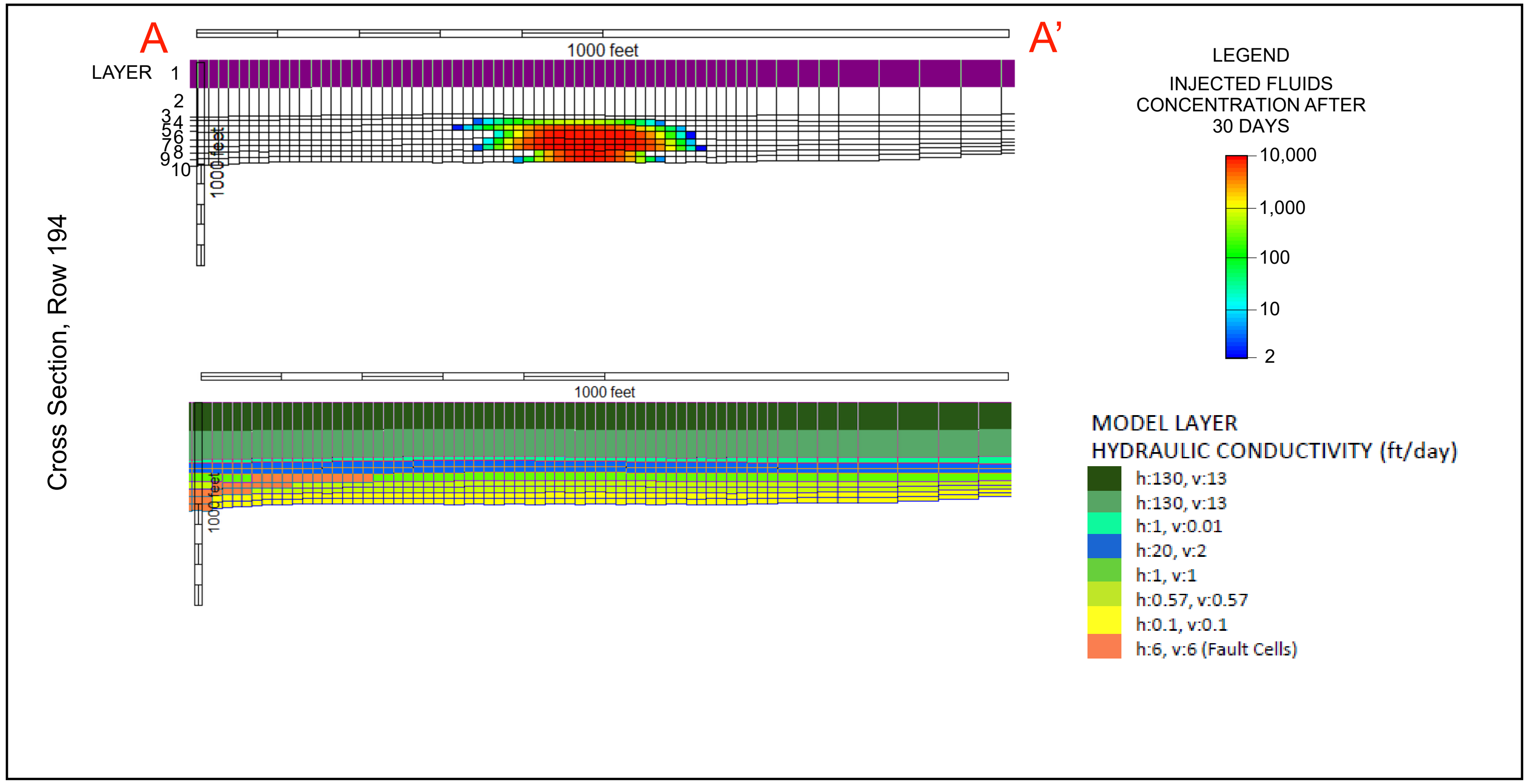


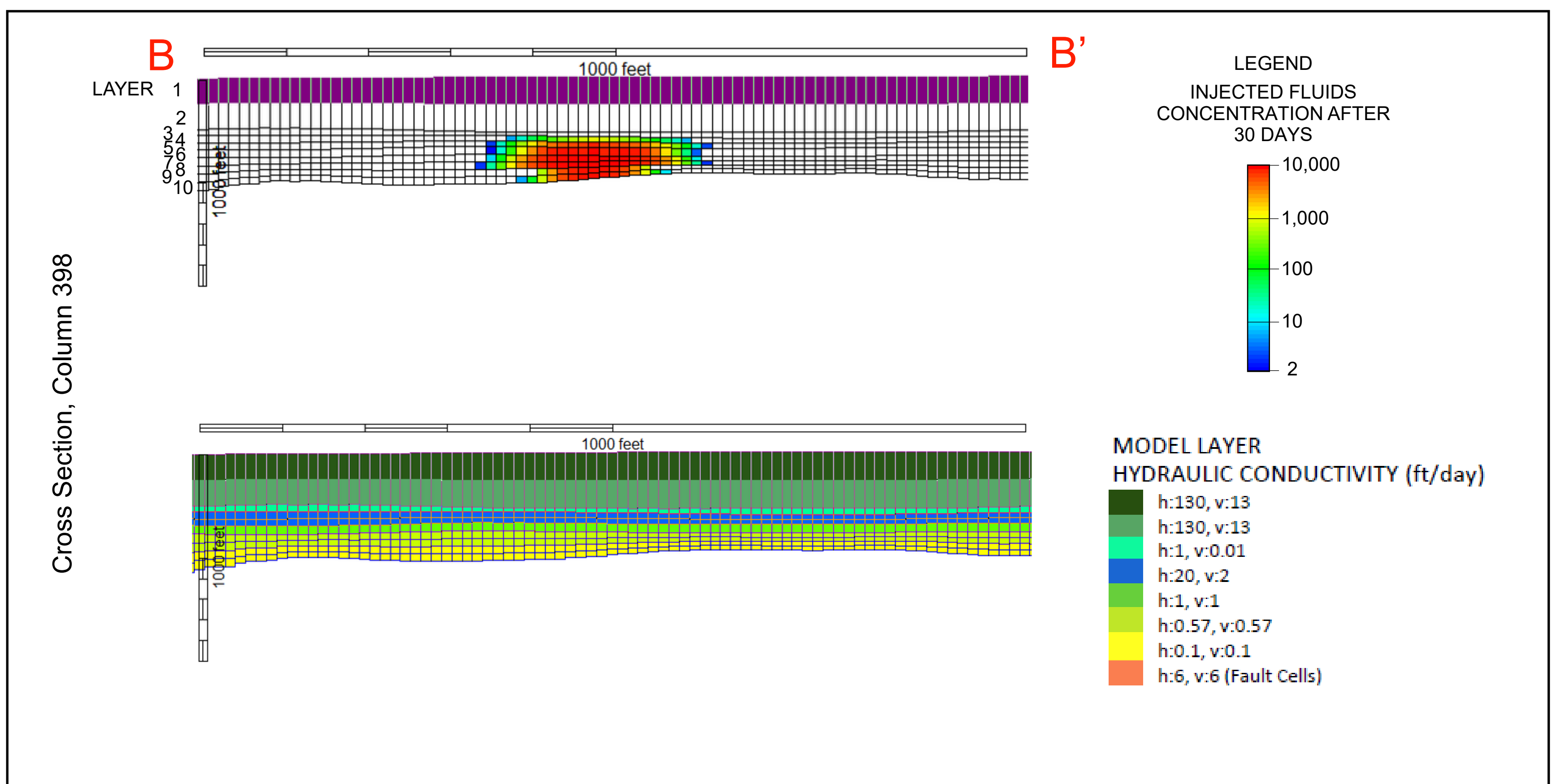
HALEY ALDRICH

CROSS SECTIONS
NE INJECTION WELL, 48 HOURS
INJECTION WITH NO EXTRACTION

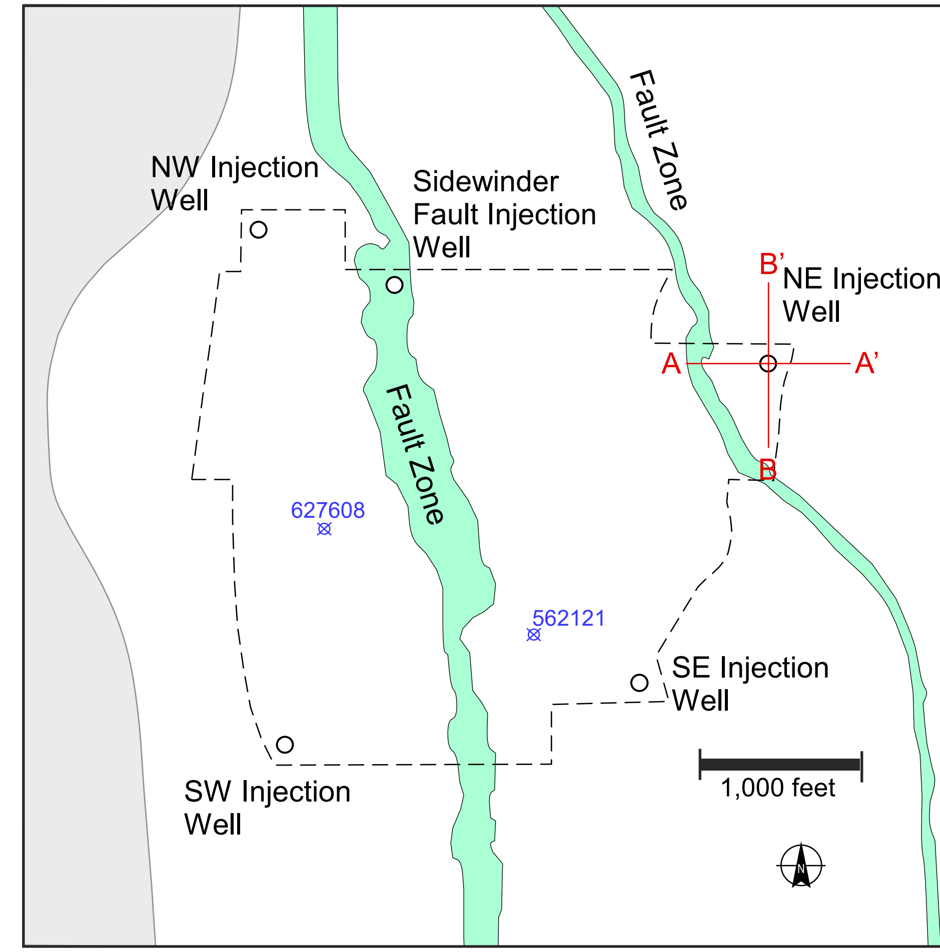
FEBRUARY 2019
REVISED FEBRUARY 2020

FIGURE A-6





FAULT LOCATION MAP

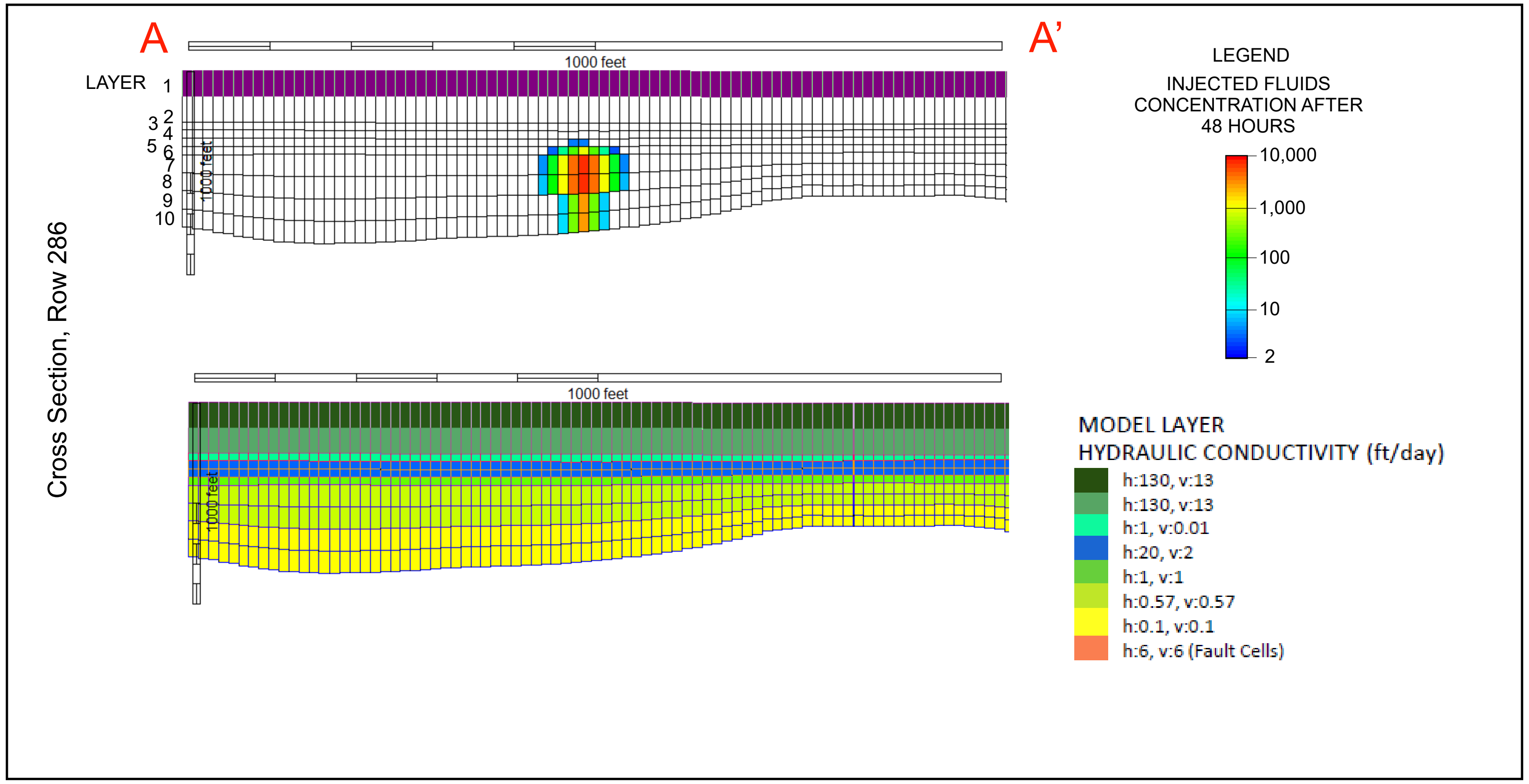


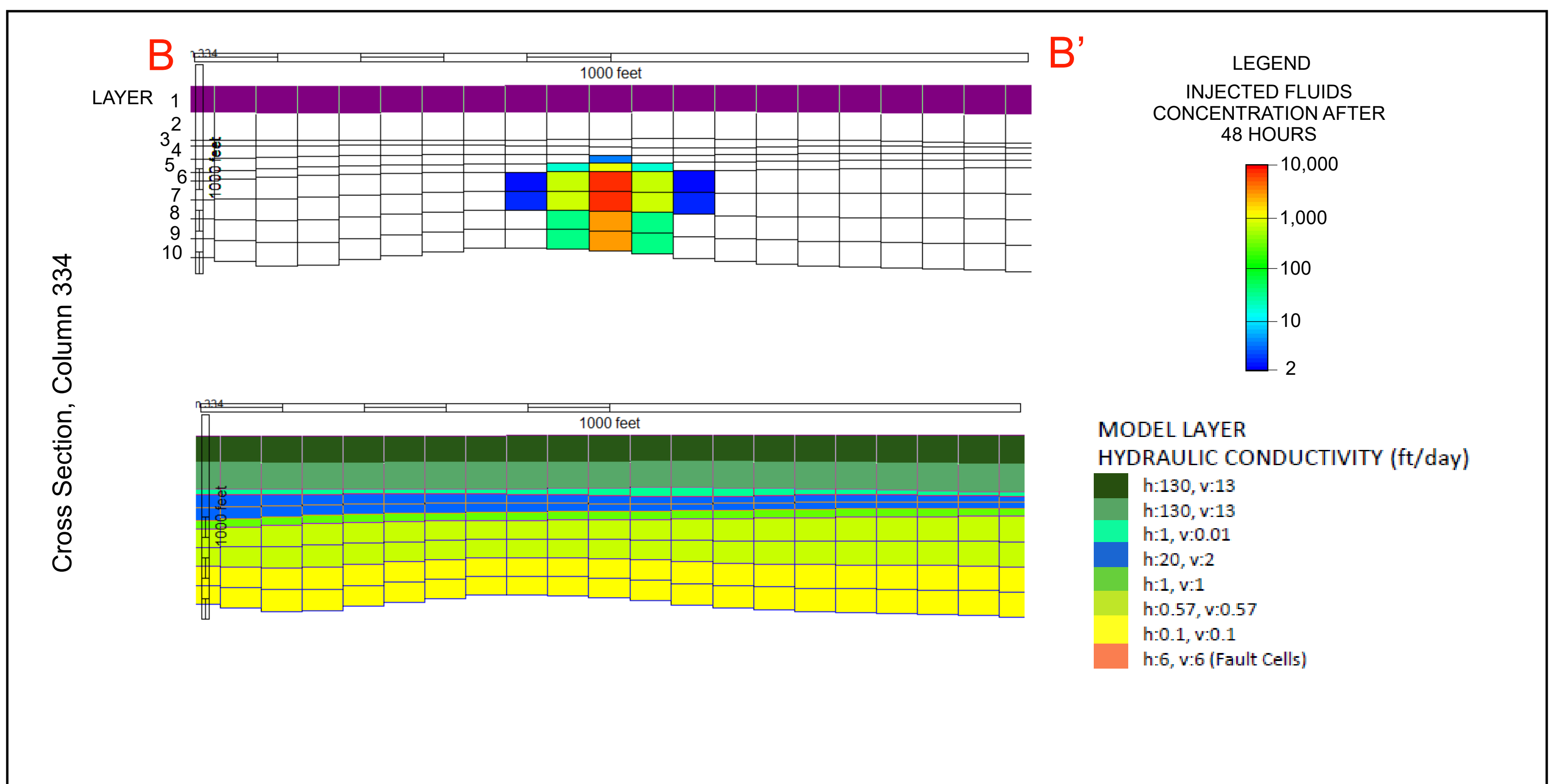
HALEY ALDRICH

CROSS SECTIONS
NE INJECTION WELL, 30 DAYS
INJECTION WITH NO EXTRACTION

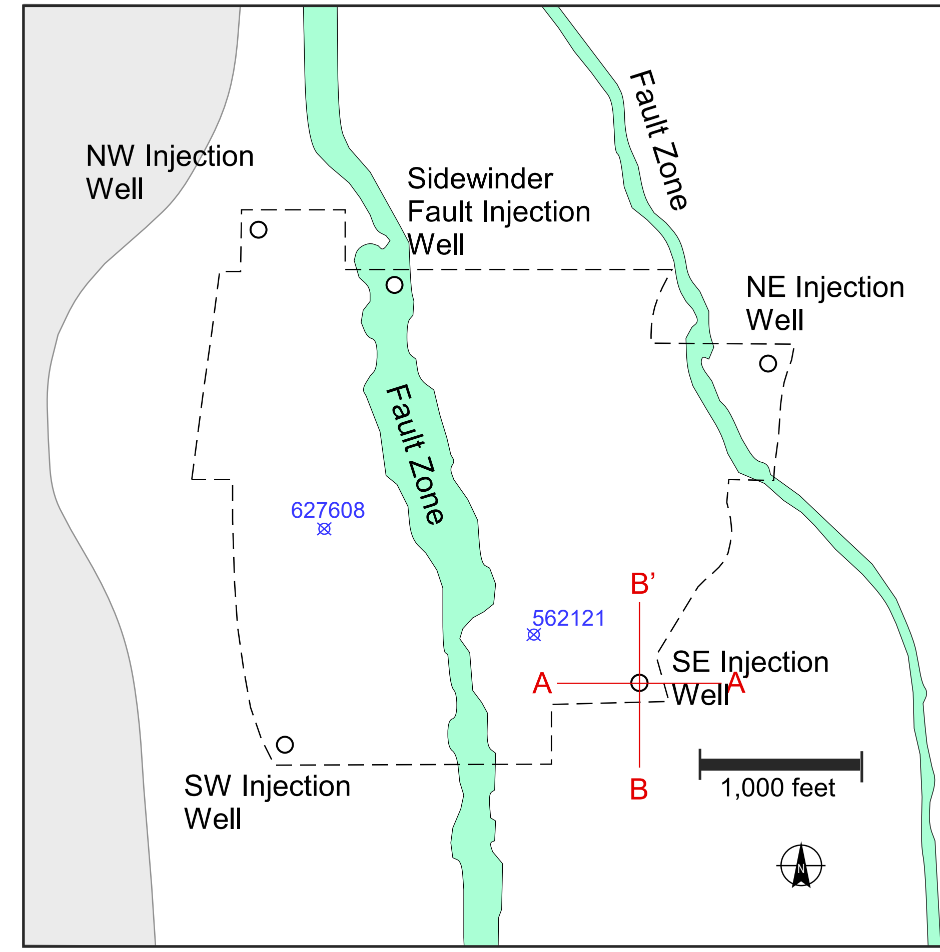
FEBRUARY 2019
REVISED FEBRUARY 2020

FIGURE A-7





FAULT LOCATION MAP

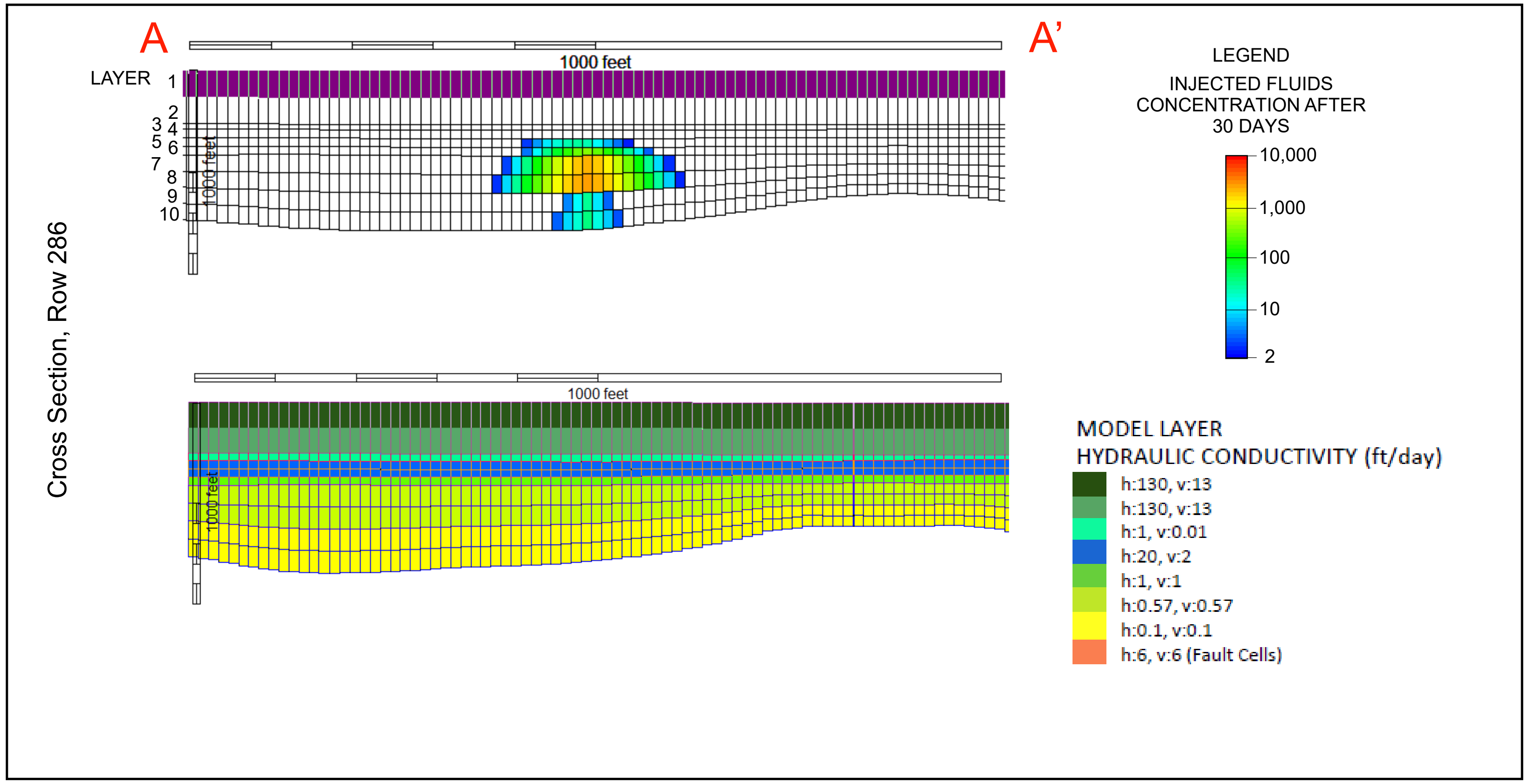


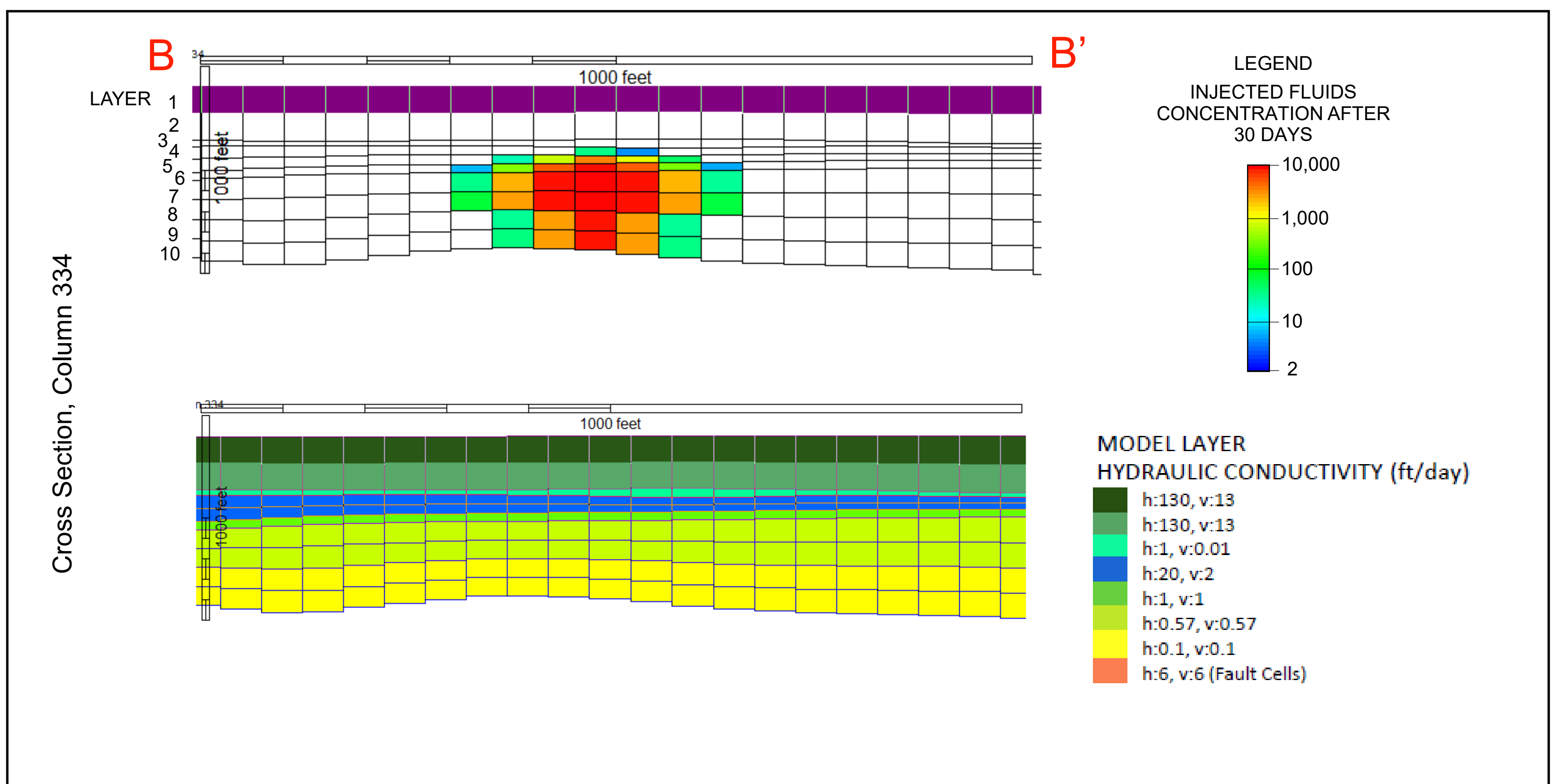
HALEY ALDRICH

CROSS SECTIONS
SE INJECTION WELL, 48 HOURS
INJECTION WITH NO EXTRACTION

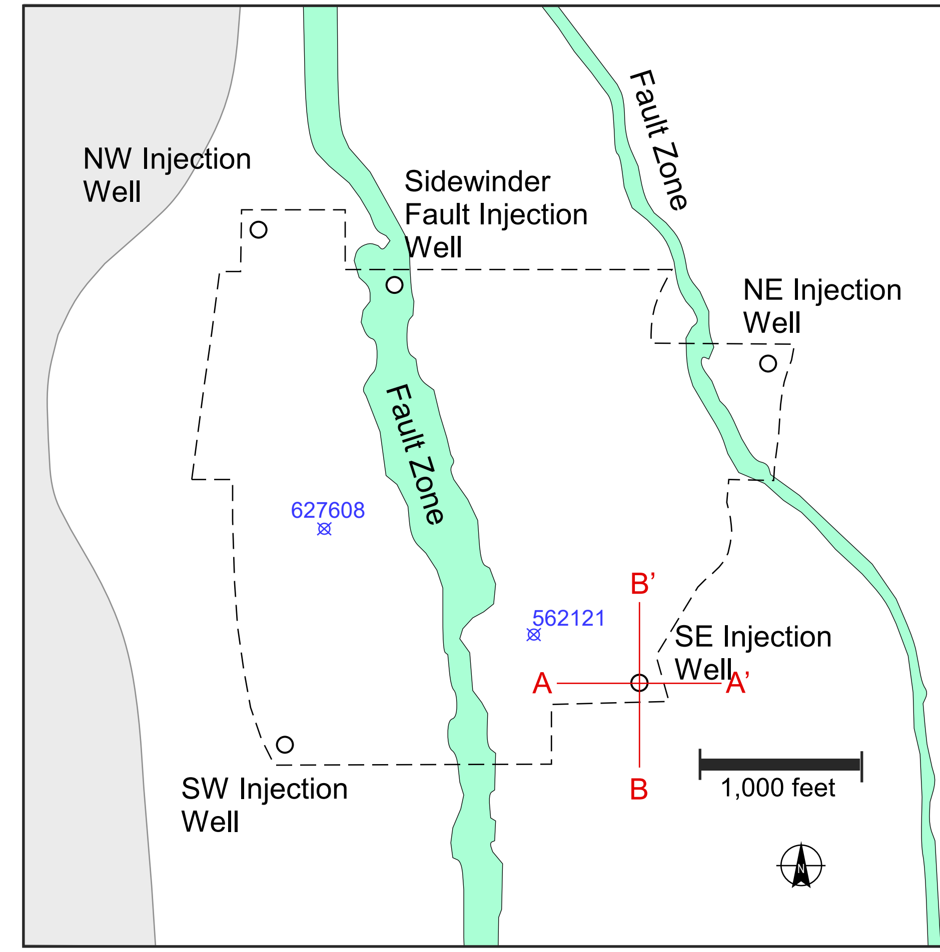
FEBRUARY 2019
REVISED FEBRUARY 2020

FIGURE A-8





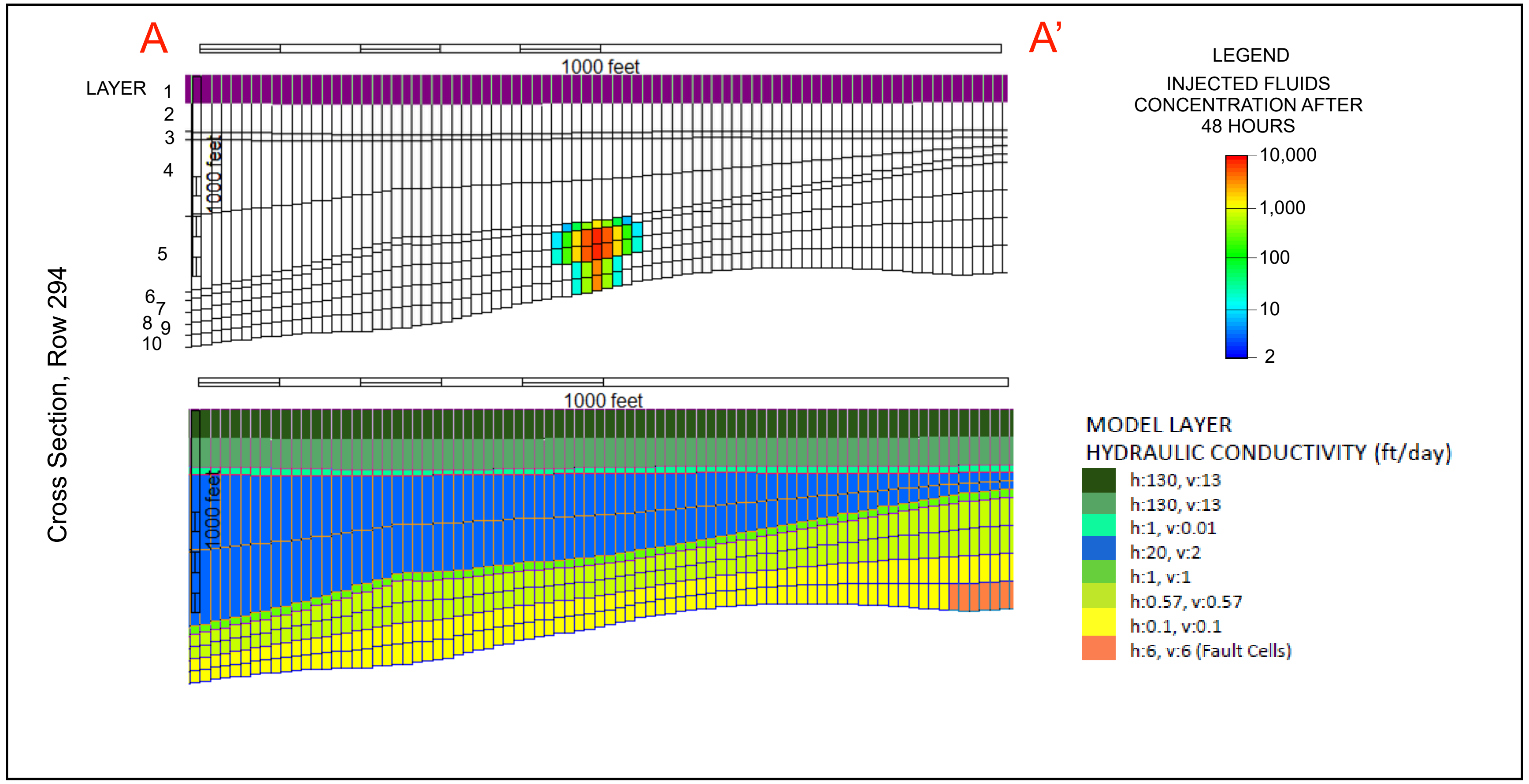
FAULT LOCATION MAP

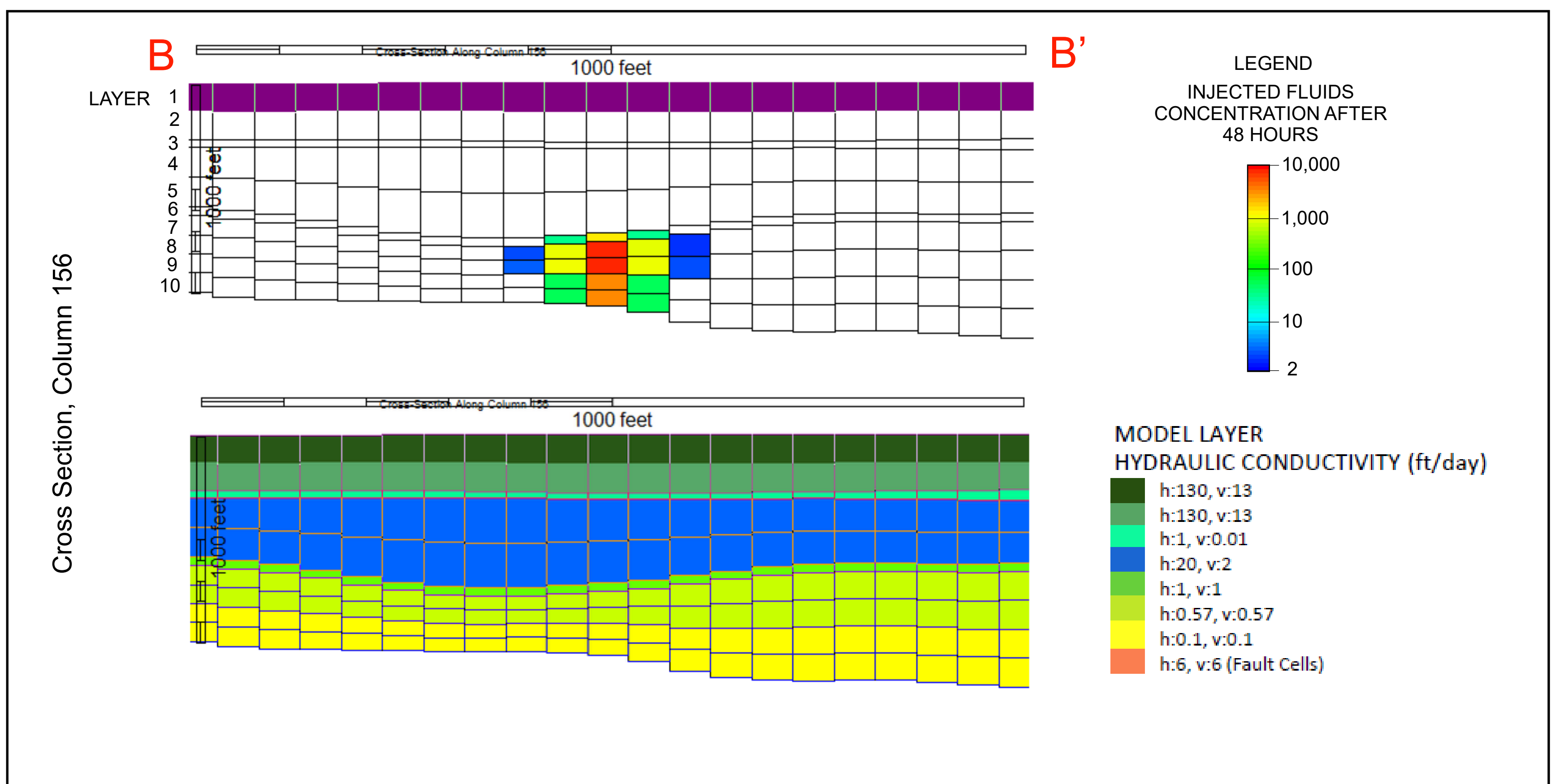


CROSS SECTIONS
SE INJECTION WELL, 30 DAYS
INJECTION WITH NO EXTRACTION

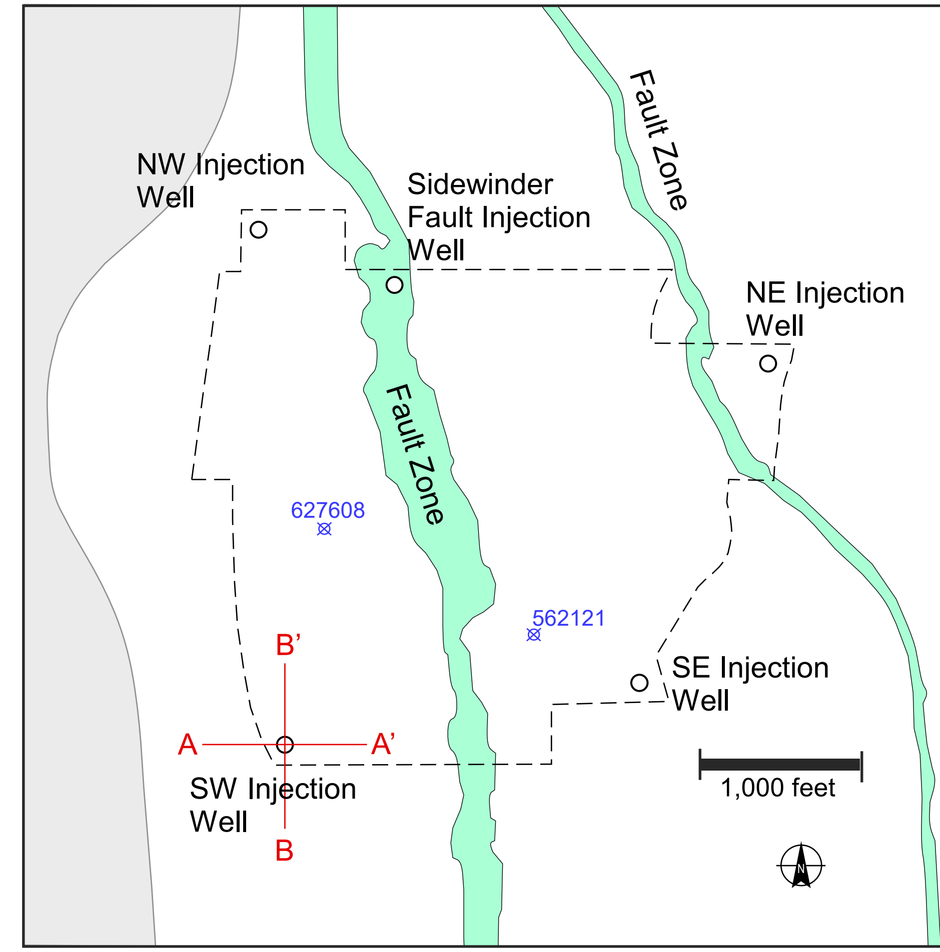
FEBRUARY 2019
REVISED FEBRUARY 2020

FIGURE A-9





FAULT LOCATION MAP

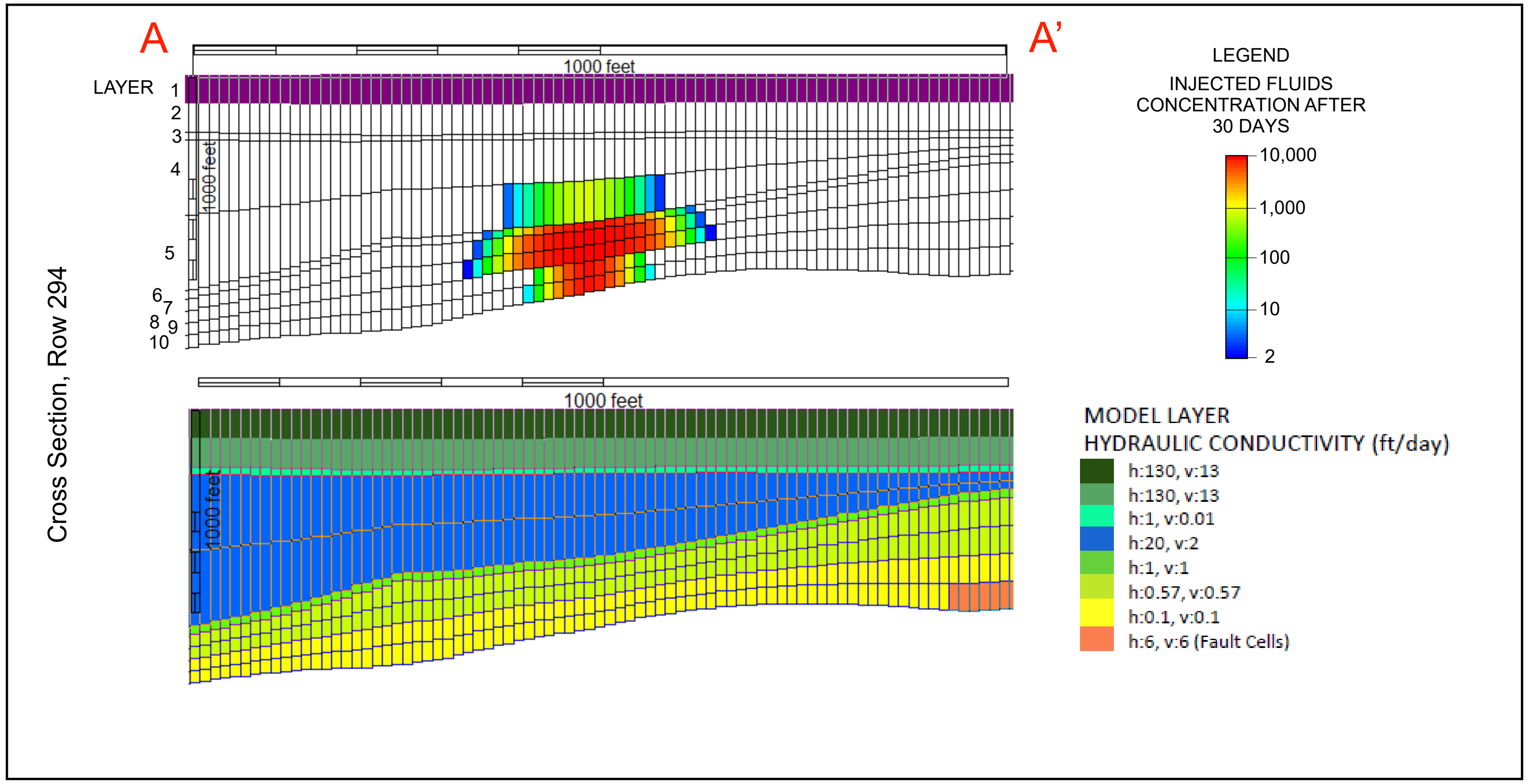


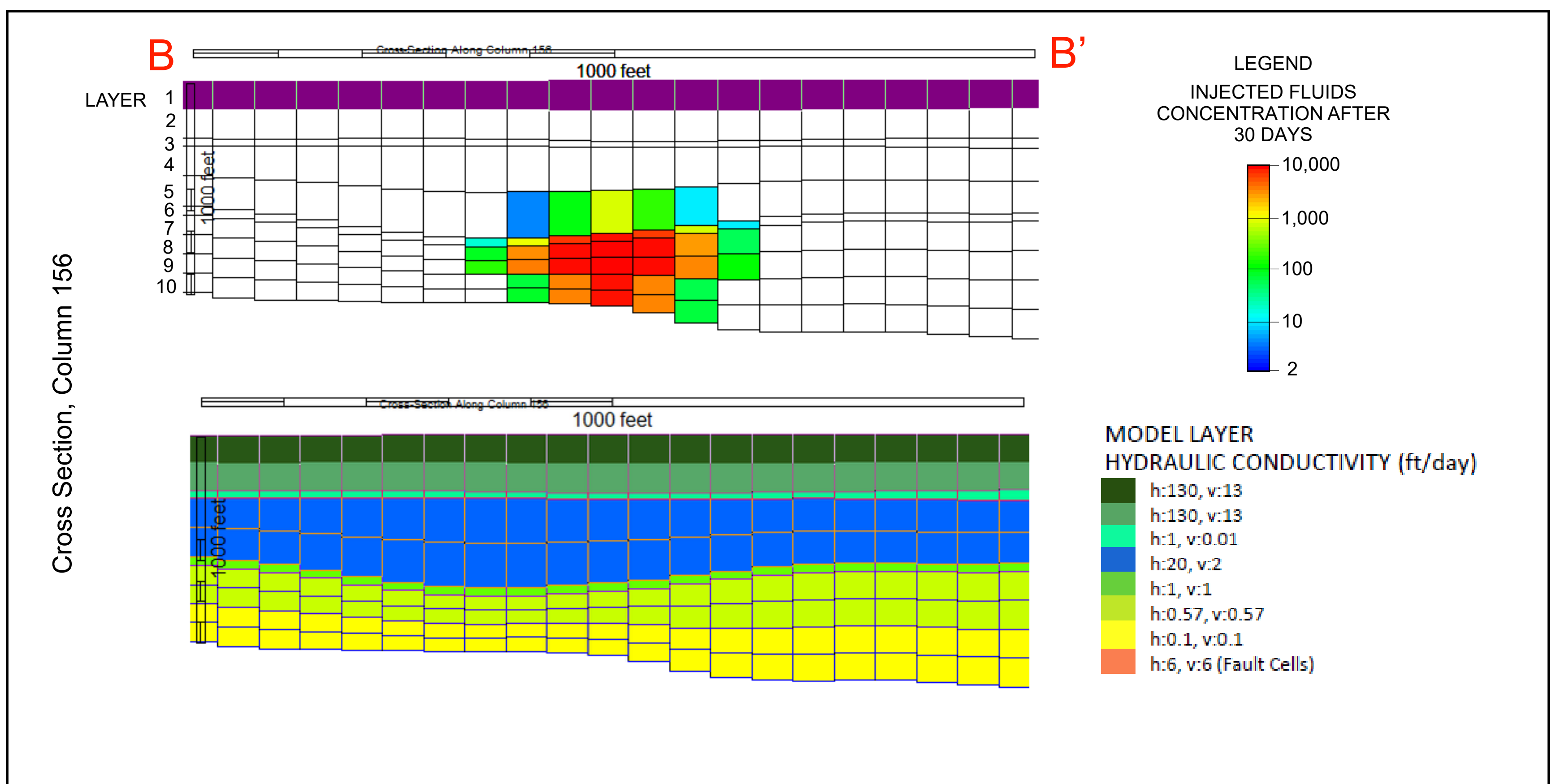
HALEY ALDRICH

CROSS SECTIONS
SW INJECTION WELL, 48 HOURS
INJECTION WITH NO EXTRACTION

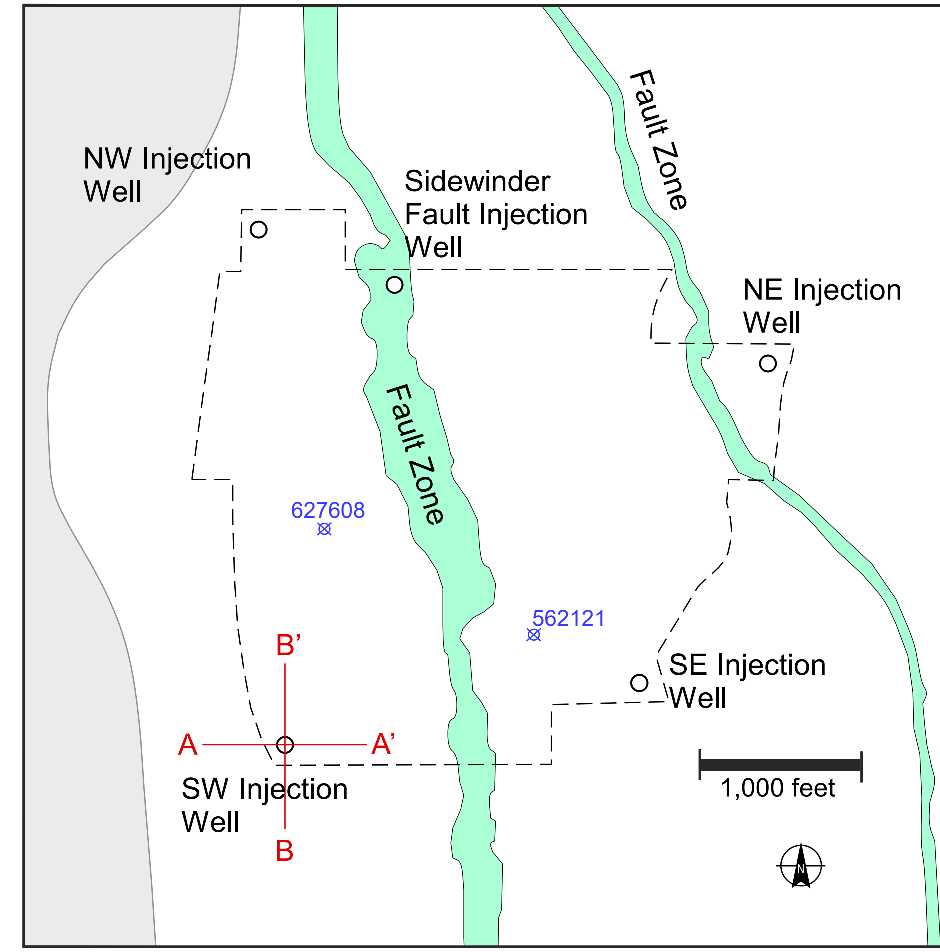
FEBRUARY 2019
REVISED FEBRUARY 2020

FIGURE A-10





FAULT LOCATION MAP

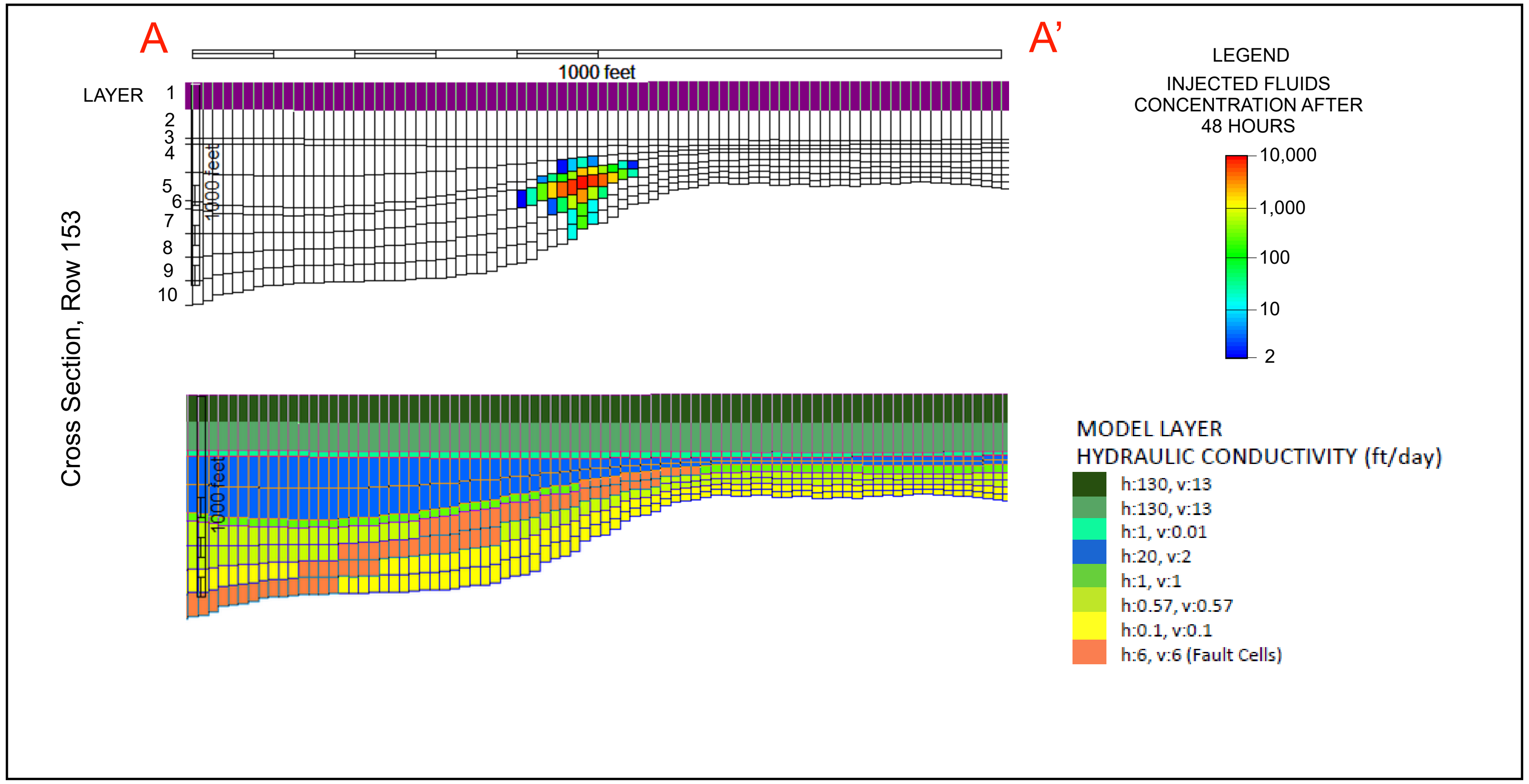


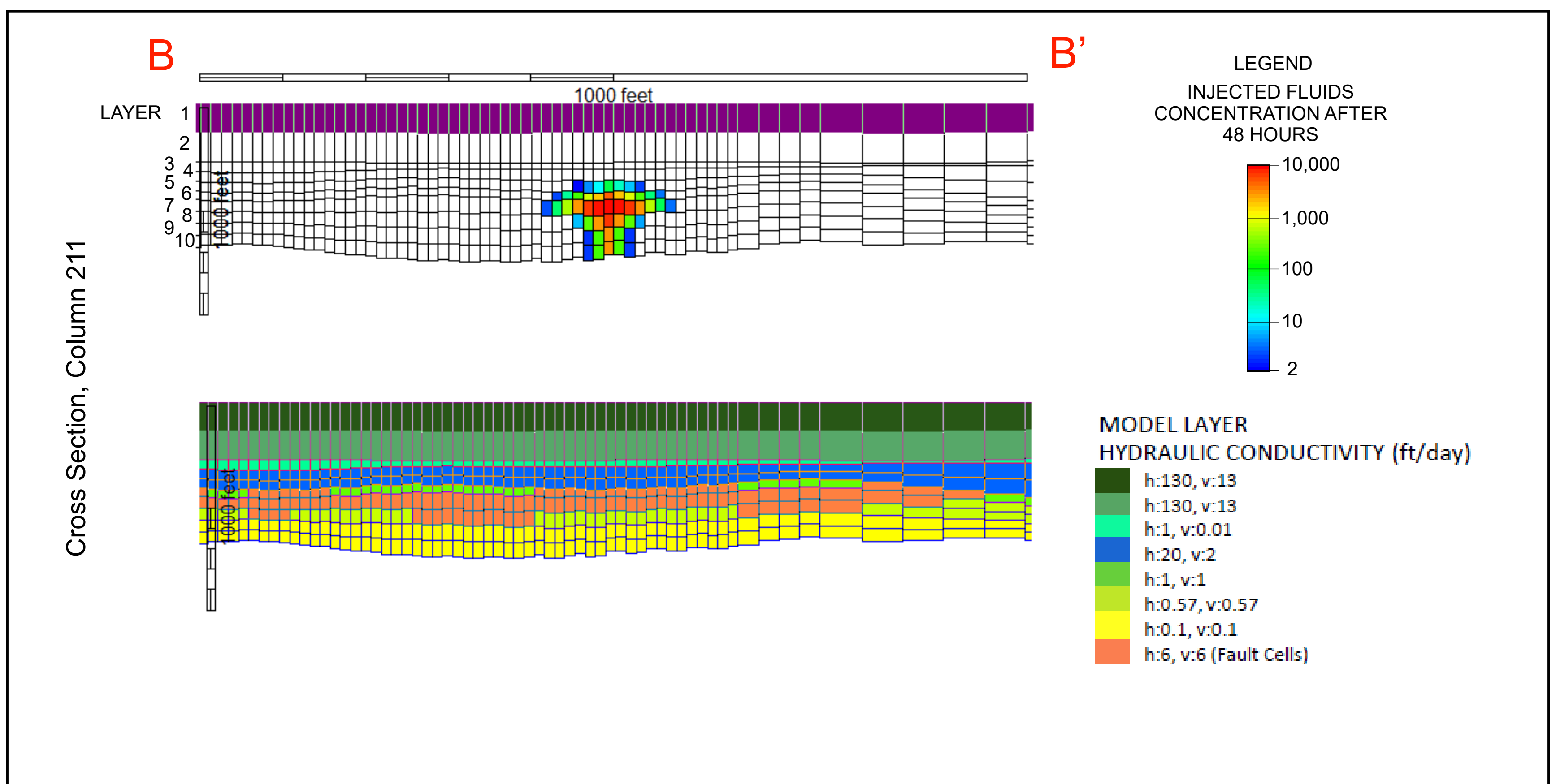
HALEY ALDRICH

CROSS SECTIONS
SW INJECTION WELL, 30 DAYS
INJECTION WITH NO EXTRACTION

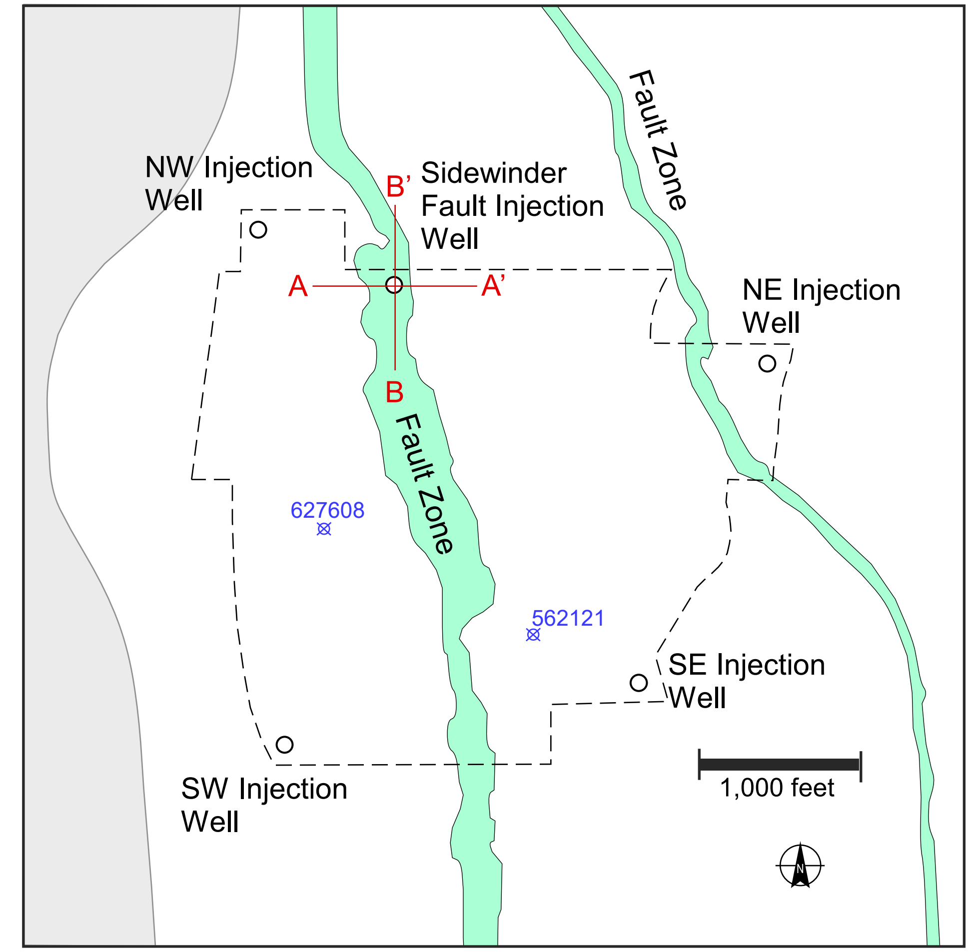
FEBRUARY 2019
REVISED FEBRUARY 2020

FIGURE A-11





FAULT LOCATION MAP

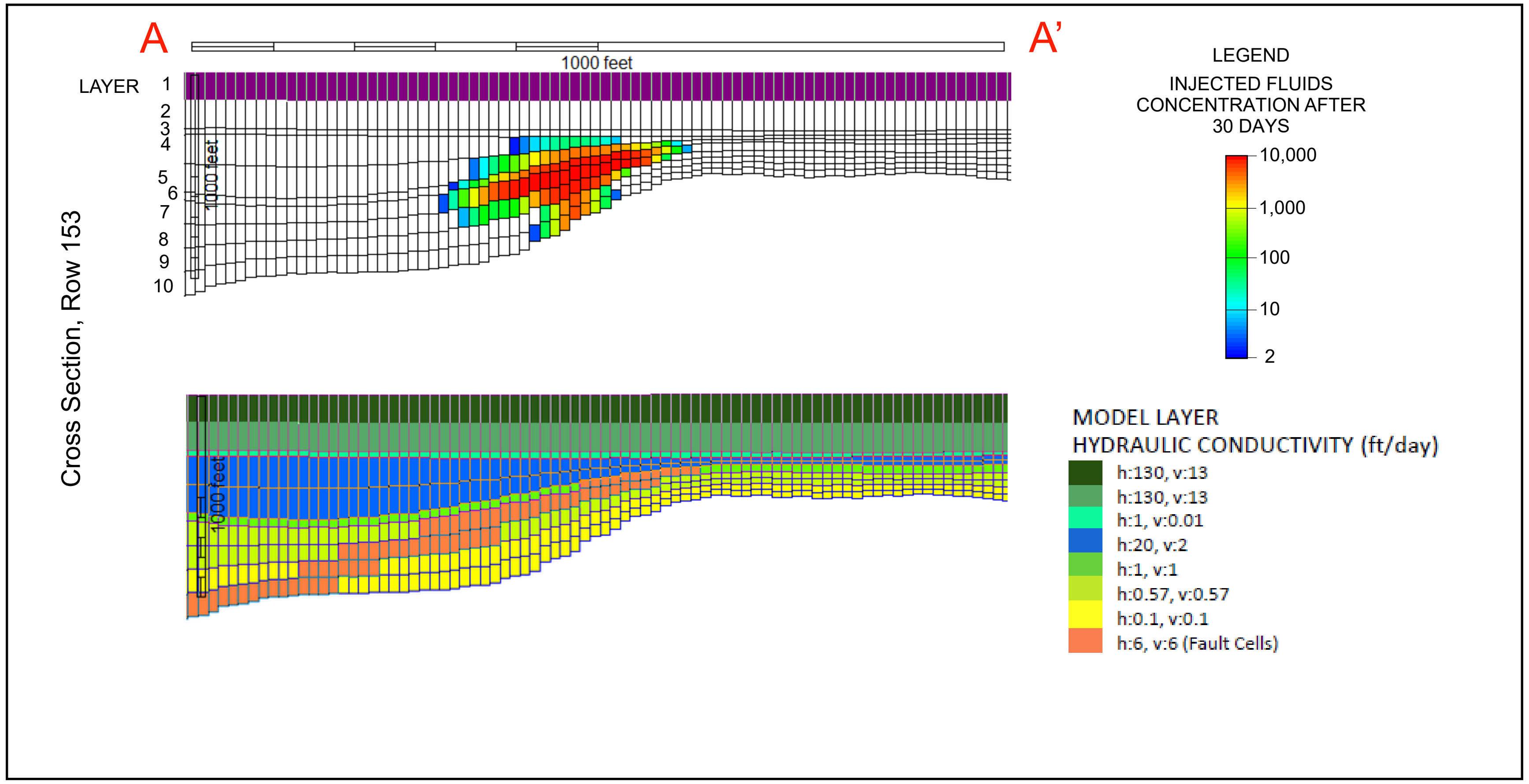


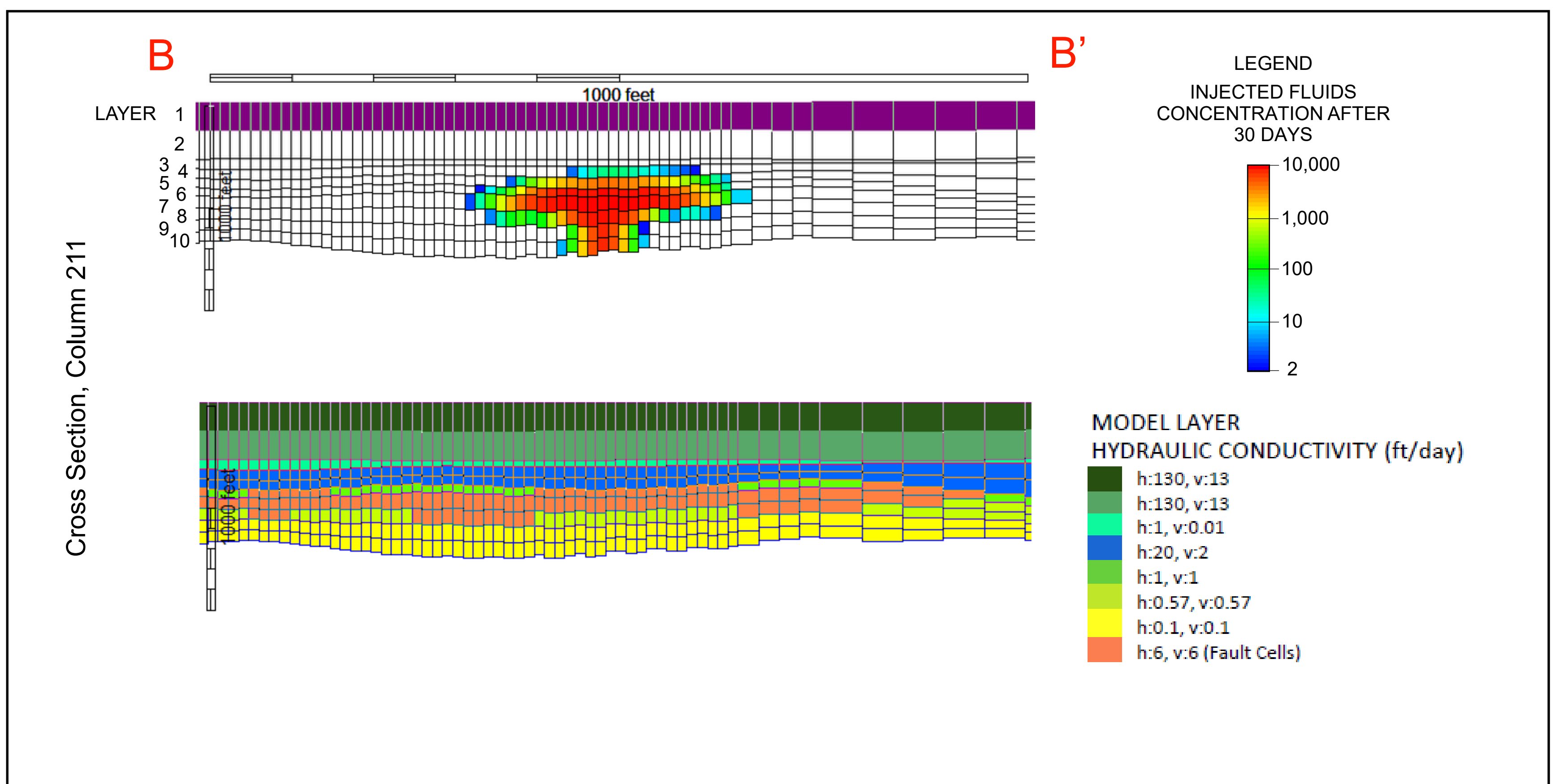
HALEY ALDRICH

CROSS SECTIONS
SIDEWINDER FAULT INJECTION WELL, 48 HOUR INJECTION WITH NO EXTRACTION

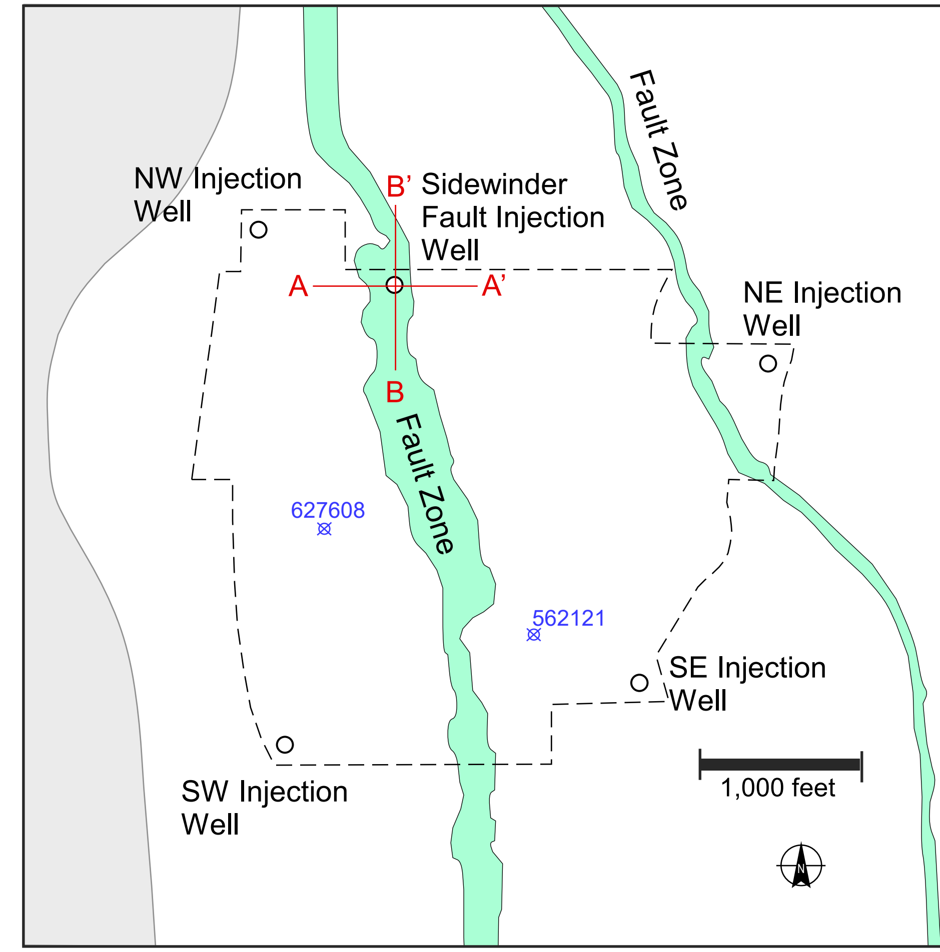
FEBRUARY 2019
REVISED FEBRUARY 2020

FIGURE A-12





FAULT LOCATION MAP



HALEY ALDRICH

CROSS SECTIONS
SIDEWINDER FAULT INJECTION WELL, 30 DAY INJECTION WITH NO EXTRACTION

FEBRUARY 2019
REVISED FEBRUARY 2020

FIGURE A-13

EXHIBIT A-8-2

Model Files

(not attached)